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**NASA GLOBAL ATMOSPHERIC
SAMPLING PROGRAM (GASP)
DATA REPORT FOR TAPES
VL0011 AND VL0013**

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NASA GLOBAL ATMOSPHERIC SAMPLING PROGRAM (GASP)
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SUMMARY

Atmospheric trace constituents in the upper troposphere and lower stratosphere were measured, from March 1975 through June 1979, as part of the Global Atmospheric Sampling Program (GASP), using fully automated air sampling systems on board the NASA CV-990 research aircraft and four Boeing 747 airplanes in routine airline service.

This report is the tenth of a series of reports which describes the data currently available from GASP, including flight routes and dates, instrumentation, data processing procedures, and data tape specifications. In-situ measurements of atmospheric ozone, carbon monoxide, clouds, and related meteorological and flight information obtained during 1122 flights of aircraft VH-EBE and N655PA from January 10 through October 2, 1977 are reported. These data are now available from the National Climatic Center, Asheville, NC, 28801. In addition to the GASP data, tropopause pressures obtained from time and space interpolation of National Meteorological Center (NMC) archived data for the dates of the flights are included.

INTRODUCTION

The objectives of the NASA Global Atmospheric Sampling Program are to provide baseline data of selected atmospheric constituents in the upper troposphere and lower stratosphere and to document and analyze these data to 1) provide a better understanding of the dynamics of the atmosphere in the region where commercial aircraft fly, and 2) provide initial value boundary conditions for atmospheric models being used to assess potential adverse effects from aircraft exhaust emissions on the natural atmosphere.

The GASP program began in 1972 with a feasibility study of the concept of using commercial airliners in routine service to obtain atmospheric data. Since then, this program has progressed from design and acquisition of hardware to collecting global data on a daily basis (refs. 1-6). Fully automated GASP systems have been operated on a

United Airlines B747, two Pan American World Airways B747's, a Qantas Airways of Australia B747, and the NASA CV-990 research aircraft. The GASP system design, the measurement instruments, the on-board computer for automatic control and data management, and system maintenance procedures are described in references 7 and 8. Analyses of GASP data are reported in references 9-17.

This report is the tenth in a series of reports to announce the availability of GASP data from the National Climatic Center, Asheville, North Carolina, 28801. Data for March 1975 through December 1976 are archived on tapes VL0001-VL0008 (refs. 18-24). Continuous record data obtained on Pan Am's Fiftieth Anniversary around-the-world-via-the-poles flight on October 28-31, 1977 are archived on tape VL0009 (ref. 25). Data from Pan Am N533PA and United N4711U for January-September, 1977 are on tapes VL0010 and VL0012 respectively (ref. 26). Data obtained by Qantas VH-EBE from January 10-October 2, 1977 are archived on tape VL0011, and data obtained by Pan Am N655PA from February 22-October 5, 1977 are archived on tape VL0013. For each of these tapes, the time periods covered, and the GASP aircraft from which data are archived are identified in table I.

DATA ACQUISITION

For each GASP flight, data acquisition begins on ascent through the 6 km altitude flight level, and terminates on descent through 6 km. A complete GASP sampling cycle is 60 minutes, divided into 12 five minute sampling segments. During alternate segments (at 10 minute intervals), air sample data are recorded for all instruments. During the intervening segments the system is in one of six different calibration cycles to allow for in-flight checks on instrument operation (if required). Whenever any calibration cycle is not needed for a given instrument, that instrument acquires air sample data during the segment. For normal GASP sampling a 16 second recording is made at the end of each five minute sampling segment.

Cassette tapes, on which the data are recorded onboard the aircraft in serial format, are transcribed to computer-compatible form for data reduction. At this stage, laboratory instrument calibration information required for data processing is included, redundant and non-usable data are removed, and the data are re-transcribed to final form and units. On the GASP archive tapes, the data are grouped by aircraft and identified by flights with the airports of departure and arrival designated by the standard three-letter airport code (ref. 27). Detailed specifications and formats for the GASP data are given in Appendix

A. Data for each flight begins with an FLHT record (table A-I) to provide flight identification information. This record is followed by a series of DATA records (table A-II), one for each recording made during the flight. Summary tabulations for tapes VL0011 and VL0013 showing the route, date, number of DATA records, and constituent data available for each flight are given in tables II and III.

MEASUREMENTS

For each in-situ constituent measurement, an instrument ID number is given in the FLHT record for each flight for which constituent data are available; otherwise, ID = 'M'. In addition, each measurement has an associated TAG in each DATA record. If TAG = 'M', data are not available for that record, and the data field has been set equal to zero.

Ozone

Ozone measurements are made using an ultraviolet absorption ozone photometer (ref. 28). The concentration of atmospheric ozone is determined by measuring the difference in intensity of an ultraviolet light beam which alternately passes through the sample gas and an ozone-free zero gas (generated within the instrument). The instrument output is digital, and the register is up-dated at the end of each 20 second measuring cycle. The range of this instrument is from 3 to 20,000 ppbv (parts per billion by volume), with a sensitivity of 3 ppbv. The GASP ozone instrument and the accuracy of the measurement are described in detail in reference 29.

Prior to February 1977, GASP ozone instruments were checked (over the range 0 to 1000 ppbv) against an ozone generator which was calibrated at 1000 ppbv by the one percent neutral buffered potassium iodide (KI) method (ref. 30). Based on the average of these KI calibrations the GASP ozone instruments read the correct ozone concentrations of an air sample at 1 atmosphere pressure and 25 degrees C when the span is set at 58200. Due to uncertainty regarding the KI procedure as a standard for ozone measurements (see ref. 31 and refs. therein), later calibrations were made by comparison with a commercial U. V. photometer maintained at Lewis as a transfer standard. This transfer standard was periodically (about every 6 months) calibrated against the Jet Propulsion Laboratory 5 meter path length U. V. photometer (ref. 31). With the span setting of the transfer standard and the GASP ozone instruments set at 58200, the JPL calibrations indicated that the GASP data were 9 percent high. To preserve GASP data consistency and inter comparability, span settings were not readjusted. Thus all

published GASP ozone data are 9 percent high compared to the JPL calibrations. This is a systematic difference, and can easily be corrected for if the KI method is determined to be incorrect, and another method such as the U.V. photometer is adopted as the standard.

In-flight monitoring of the ozone instrument included measurement of the instrument zero by flowing the sample through a charcoal filter external to the instrument, and measurement of the electronic span setting and control frequencies. The instruments were not calibrated in-flight with an ozone calibration gas due to the difficulty of generating a precisely known ozone concentration in the flight system. Periodic checks for calibration consistency were performed in the laboratory.

Ambient ozone measurement. The air sample is pressurized to nominally 100 kPa (1 atm) prior to measurement of the ozone level. The ozone readings are corrected for drift of the instrument zero by subtracting the most current zero-level reading. To account for differences in regulated pressure between GASP systems, and to account for variations in the air sample temperature and pressure during flight, the zero-corrected ozone levels are normalized to standard atmospheric pressure and to a temperature of 25 degrees C. Data are not reported if the pressure of the sample entering the ozone instrument is less than aircraft cabin pressure.

The destruction of ozone in the tetrafluoroethylene (TFE) sample lines from the inlet probe to the instrument, and in the TFE-coated diaphragm pump is periodically measured on board the aircraft under conditions simulating operation in flight. The ozone mixing ratio at the probe inlet (O_3 , in ppbv) is expressed in terms of the measured ozone mixing ratio (O_3m , in ppbv) as

$$O_3 = (1+a)O_3m \quad (1)$$

with the constant 'a' determined by a regression analysis on the appropriate destruction test data. For the data reported on tapes VL0011 and VL0013, the ozone destruction corrections were made using $(1+a) = 1.082$ and $(1+a) = 1.041$ respectively. The uncertainty in these approximations is ± 2 percent. The destruction constants used are given in the PLHT record for each flight (see table A-I).

In previous reports (refs. 19-24) a more complicated form of equation (1) was reported which accounted separately for destruction of ozone by thermal and wall effects (refs. 32-34). Although the percentage of the incoming ozone destroyed by wall effects decreases with increasing concentrations, the percentage of the incoming ozone

destroyed by the thermal mechanism increases with increasing concentration. Since both mechanisms are likely contributing to the system destruction, it is not surprising that the destruction data are approximated well with a linear relationship which gives a constant percentage destruction.

As mentioned above, reported ozone levels have been corrected for drift of the instrument zero, for differences in the densities between the sampling and laboratory conditions, and for ozone destruction in the sample lines and pump. Zero level data appear in cal cycle 1 and are identified by a 'Z' tag. The density ratio factor is given by RHOR in the DATA records. Ozone data values reported have been calculated as follows:

$$O3 = (1+a) * (RHOR) * (O3r - O3z) \quad (2)$$

where

O3z is the most current zero

O3r is the measured (uncorrected) ozone mixing ratio

RHOR is the density correction

(1+a) is the destruction correction (see Eq. (1))

Three ozone data values are reported in the DATA records (see table A-II). The reading at the time the recording is made is O3. The mean ozone level for the 128 seconds preceding the recording is O3A, and the standard deviation of the measured ozone levels for that period is O3S. Because for some DATA records O3 is available, but O3A and/or O3S are not, all three values are tagged separately. Note that during continuous recordings (MODE = 10, or TYPE = 'L', or TYPE = 'C') O3A = O3S = 0 and their respective tags are set equal to 'M'.

Ambient ozone data obtained by aircraft VH-EBE from 4/9/77 through 9/9/77 (tape VL0011, files 2-5) are identified by O3TAG = 'L' because the instrument from which they originated was found to be reading 36.5 percent low when it was recalibrated in January 1978. Since the cause of this failure is thought to be gradual degradation of the ozone scrubber in the instrument, a reasonable assumption would be that the data were OK when the instrument was installed, were 36.5 percent low when it was removed, with an increasing error during the installation period.

For analyses being performed in-house at Lewis, we are using a parabolic correction with time, which is consistent with the above criteria, and also assumes that the instrument had not yet begun to fail when installed. Note that the 'L'-tagged data on tape VL0011 are not corrected, so any adjustment must be made during analysis. For some analyses, these data may not be usable, but for most

purposes a simple correction will probably suffice to recover 5 months of data which would otherwise have to be edited out.

Carbon Monoxide

The carbon-monoxide measurement is made with an infra-red absorption analyzer using dual isotope fluorescence. In the dual isotope fluorescence technique, alternating pulses of IR radiation spectra from a single source are produced that are an exact match of the vibrational-rotational absorption bands of $\text{C}^{12}\text{O}^{16}$ and $\text{C}^{13}\text{O}^{16}$. These two IR radiation spectra are passed through a single air-sample chamber. The CO present in the air sample (98.9% of all naturally occurring carbon-monoxide is $\text{C}^{12}\text{O}^{16}$) will absorb the $\text{C}^{12}\text{O}^{16}$ radiation but not the $\text{C}^{13}\text{O}^{16}$ radiation. Thus the $\text{C}^{13}\text{O}^{16}$ radiation pulse is a reference against which the absorption of $\text{C}^{12}\text{O}^{16}$ can be measured. After passing through the air-sample chamber, the alternating radiation pulses are converted to electrical signals by a solid-state IR detector. Ratio comparison of the two signal levels yields a voltage corresponding to the CO concentration in the air sample.

The air sample, pressurized to 100 kPa (1 atm), passes through a dessicant cartridge to remove water vapor, and through a particulate filter before admission to the air-sample chamber. Inlet pressure and temperature are measured to permit corrections for density effects. Data are normalized to standard atmospheric pressure and to a temperature of 25 degrees C. The analyzer zero-output level is monitored at 20 minute intervals by diverting the air sample through a heated, hopcalite scrubber to remove all traces of CO from the air sample. Carbon-monoxide concentrations are corrected for zero drift by subtracting the most current zero-output level as discussed below. The electronic gain of the analyzer is monitored once per hour.

Output of the analyzer is a linear 0 to 5V DC signal corresponding to the CO level of the air sample. Sensitivity, adjusted during calibration, is 250 ppbv per volt. Limit of detectability is 20 ppbv. Because a change in analyzer ambient temperature causes a zero shift, and because the data system cannot accept a negative voltage, the zero-output level is set at 2V DC. Full scale output thus corresponds to 750 ppbv.

The analyzers are calibrated with CO in nitrogen gas mixtures obtained from the National Bureau of Standards. The CO content of these mixtures is accurately known so as to serve as NBS Standard Reference Materials. The lowest concentration of CO obtainable as an NBS/SRM is about 10

ppmv. Therefore, a precision flow blender is used to dilute this mixture with proportionate amounts of CO-free nitrogen to obtain sample flows in the range of 100 ppbv to 900 ppbv. Calibrations using the diluted NBS/SRM are estimated to be accurate to within \pm 2 percent.

Early in the GASP program, calibrations were also performed with nitrogen cylinders whose CO content was determined from a comparison with an NBS/SRM calibration. The use of these span gases for calibration has been discontinued because of the variability of the CO level over a period of time.

Each analyzer is calibrated prior to its installation on an aircraft. A check on this calibration is performed upon its removal to determine any change in sensitivity. Uncertainty of the CO measurement is the result of calibration errors, change in sensitivity between calibrations, and random fluctuation of the output signal. For the data reported herein, the measurement error ranges from \pm 4 to \pm 10 percent of reading due to calibration error and sensitivity change. The standard error due to random fluctuation of the output signal is \pm 14 ppbv. The GASP CO measurement is described in more detail in reference 35.

Carbon monoxide data are processed according to the following:

$$CO = .25(RHOR)(COv - COz) \quad (3)$$

where

COz is the most current zero (mv)

COv is the local CO voltage (mv)

RHOR is the density correction

During the course of each flight, the CO zero level may vary appreciably. Because the data reduction always uses the 'most current' values available, and new COz's are obtained at nominally 20 minute intervals, COz variations can introduce errors in the reported CO mixing ratios. For example, if the true CO mixing ratio is constant, a difference of 100 mv in two consecutive zeros would result in an error of up to 25 ppbv in the reported CO level. To assist in identifying data which may have a significant error due to zero level variation, any COz reading which differs from the previous zero by more than 100 mv has had the normal 'Z' tag replaced with a 'C' tag. CO data readings that occur between 2 zeros that differ by more than 200 mv have been edited out.

Three carbon monoxide data values are reported in the DATA records (see table A-II). The reading at the time the recording is made is CO. The mean carbon monoxide level for

the 128 seconds preceding the recording is COA, and the standard deviation of the measured carbon monoxide levels for that period is COSD. Because for some DATA records CO is available, but COA and/or COSD are not, all three values are tagged separately. Note that during continuous recordings (MODE = 10, or TYPE = 'L', or TYPE = 'C') COA = COSD = 0 and their respective tags are set equal to 'M'.

Cloud Detector and Light Scattering Particles

Flight test experience with the light-scattering particle counters included in the GASP systems (see ref. 3) has indicated that flight through clouds results in a significantly greater count of the largest size particles ($D > 3$ micrometers) than is obtained in clear air. A simple cloud detector is thus available by observing the counting rate of the largest size particles. This signal is monitored for 256 seconds prior to each data recording. The time (in seconds) during which the cloud rate, CLDRT, is greater than a preset level, CLDHI, is interpreted as time in clouds (CLSEC; see table A-II). The CLDHI level was programmed on board the United airliner based on visual observation of a light haze, and corresponds to a local particle density (for $D > 3$ micrometers) of 66,000 particles/cubic meter. If CLSEC > 0, CLTAG = 'C'. If cloud data are not available, CLTAG = 'M'.

The number of cloud encounters (CLAYR; see table A-II) is also available. Whenever clouds are detected (CLDRT > CLDHI), this is interpreted as a continuous encounter until cloud-free air is detected. This determination requires a second preset level, CLDLO. If n is the number of times that the cloud rate crosses CLDHI and CLDLO (or CLDLO and CLDHI) in succession, then CLAYR = $(n+1)/2$. For the data reported herein CLDLO was set at CLDHI/8.

Except for clouds, data from the light scattering particle counters have not been reported previously due to a rather large uncertainty in the total particle count resulting from nonuniform illumination of the sample volume, and high noise-to-signal ratios on channels measuring particles less than 1.4 microns in diameter. However, in response to requests, and as a supplement to the time-in-clouds data, measured particle densities, in particles/ambient cubic meter, are reported for particles $> .45$, > 1.4 , and > 3 microns in diameter. The latter channel is the one used by the cloud detector, although the particle densities are obtained over a 60 second sampling period, whereas the sampling time for the cloud detection is 256 seconds.

The particle density data reported are subject to variations between instruments due to differences in illumination of the sample volume. Our preliminary indication is that the resultant difference in magnitude may be on the order of $\pm 1/2$ cycle (X or / by a factor of 3). A detailed mapping of the sample volume light field has not been made for any of the instruments flown on GASP B747's nor has any attempt been made to correct or normalize the data. It should also be noted that the minimum detectable particle density is approximately 30 particles/ambient cubic meter.

Particle density and cloud data are reported when available in the DATA record for each sampling period. There are no calibration cycles for this instrument, so all CYCLES are data. Since a pre-recording sampling period is required for these measurements, data do not appear for continuous recordings (MODE = 10, or TYPE = 'L'). For all flights in which particle or cloud data are reported, the instrument ID number is given in the FLHT records, otherwise PCSID = PCEID = 'M'.

Filter Samples

Atmospheric concentration data for sulfates, nitrates, chlorides, and fluorides are provided by exposure and subsequent laboratory analysis of filter samples. Filter exposures are programmed to occur at altitudes greater than 9.6 kilometers on the first flight of every third calendar day, provided that an unexposed filter is available. Filters are normally exposed for two hours, although shorter exposures may occur if the aircraft descends to an altitude less than 9.6 kilometers before two hours have elapsed.

Filter data are included in the FLHT record (table A-1) for each flight. If an exposure occurs (FILEX = 'T'), and if data from the laboratory analysis are available (FDATA = 'T'), the date, time, altitude, and position for the beginning and end of the exposure period, the type of filter, and the constituent data are reported. The data from the laboratory analysis (in micrograms/filter) are divided by the integrated filter flow rate (in ambient cubic meters), and data are reported as micrograms/cubic meter.

Multi-filter apparatus. The multi-filter apparatus is an enclosed slide mechanism which accommodates a filter magazine containing eight individual filter holders. Filter insertion, retraction, and advancement are automatic upon command from the GASP system control unit. Airflow for the apparatus is supplied from an external probe (25 mm diameter) and expanded in the sampling duct (67 mm diameter).

Filter preparation. All filter exposures for which data have been reported to date were made using IPC-1478 filter paper. This is a low resistance, cellulose type material made from second cut cotton linters with cotton scrim backing for added strength. This paper was specially designed for high altitude air sampling and thus features low pressure drop, high flow rate, and good retention for small airborne particles. This paper is impregnated with dibutoxyethylphthalate during manufacture to improve collection efficiency.

Prior to use, this paper must be washed to remove residual amounts of water soluble contaminants (ref. 36). A semi-automatic washing apparatus is available to process up to 25 filters at one time. An auxiliary tray is loaded with individual filters each sandwiched between stainless steel support screens. The washing procedure is essentially as follows:

- a) Immerse filters in carbonate buffer solution (0.024M sodium carbonate and 0.030M sodium bicarbonate) and soak for 5-10 minutes.
- b) Rinse in deionized water about 3 times.
- c) Immerse in 0.1M acetic acid solution and soak for 3-5 minutes.
- d) Rinse in deionized water about 3 times.
- e) Wash filter group at least 4 times in automatic-cycling washer system using deionized water saturated with dibutoxyethylphthalate.
- f) Dry in washer chamber with clean filtered air warmed to 36-40 degrees C.
- g) Place filters in dessicator and vacuum dry overnight.

Samples from each wash group are analyzed for background levels of contamination to verify the washing procedure.

Upon acceptance, the group of filters is transferred to a clean room for filter holder assembly and sealing. The filter holder assemblies are sealed in ultra-clean polyethylene bags to prevent contamination during shipping and handling. After filter exposure and removal from the aircraft, each magazine is re-bagged and carefully re-packaged for return shipment and analysis.

Filter analysis. Prior to analysis, each filter is cut into four equal segments for separate constituent analysis, if necessary, and for comparative repeat analyses. Sulfate, nitrate, chloride, and fluoride ion concentrations are determined by ion chromatography. The basics of this analysis technique are described in references 37-39. This procedure requires wetting a filter segment with 10 ml of carbonate buffer (0.0024M sodium carbonate; and 0.003M

sodium bicarbonate) as the extracting solution. A 0.5 ml sample is injected into the ion chromatograph flow system, which includes a carbonate eluent background, an anion separator column, a suppressor column for anion conversion to its acid form, and a conductivity detector.

The instrument is calibrated using solutions with known concentrations of the various anions in the extractant. Calculations of the anion concentration are made by comparing the constituent peak heights from the sample chromatograms to those obtained with the standard calibrating solution. The fluoride ion identification is still tentative. Further verification is necessary because the possibility of an interfering agent has not been completely eliminated.

The net amount of any constituent on a filter was deduced by subtracting an average background level determined from several reference filter blanks which were removed from unexposed filter holder assemblies. The background levels in micrograms per filter were approximately 1.9 for sulfate, 7.7 for nitrate, 3.3 for chloride, and 3.3 for fluoride. No other adjustment for any contamination due to handling and shipping was made. A summary of the filter data on tape VL0013 is provided in table IV.

Additional information, including analyses of GASP filter data, is provided in reference 40.

FLIGHT AND METEOROLOGICAL DATA

In addition to the air sample measurements, aircraft flight data are obtained with each data recording to precisely describe conditions when the data are acquired. Aircraft position, heading, and the computed wind speed and direction are obtained from the inertial navigation system (INS). Altitude, air speed, and static air temperature are collected from the central air data computer (CADC) in the aircraft. Date and time are provided by a separate GASP clock-calendar unit. The above parameters are obtained once per DATA record. The vertical acceleration of the aircraft is obtained from the aircraft flight recording system at the rate of 8 per second which provides 32 data points for each DATA record. The formats and units for these data are given in table A-II.

The programming for the GASP systems initiates a continuous recording whenever the vertical acceleration of the aircraft exceeds preset limits. This recording then continues until the acceleration has remained within limits for one minute. These limits are currently set at 0.8 and

1.2 G's to correspond to "light-to-moderate" turbulence. Continuous recordings triggered by an acceleration limit are identified by TYPE = 'L', and the number of times (out of 32) that the acceleration has exceeded the limits is given by NE (see table A-II). For any flight during which one or more limit recordings occurred, LIMCHK = 'T' in the FLHT record for that flight (see table A-I).

For each DATA record, the date, time, latitude, and longitude have been used to calculate the solar elevation angle (ref. 41). This is designated as ZEN in table A-II. Note that $-90 \text{ deg} < \text{ZEN} < +90 \text{ deg}$, where ZEN = $+90 \text{ deg}$ if the sun is directly overhead. The flight altitude is used to determine the solar elevation angle at sunrise and sunset, and day and night observations are identified by SUNTAG = ' ' and 'N' respectively. If GMT is not available for a given record (GMTTAG = 'M'), SUNTAG = 'M', and ZEN = 0.

The primary purpose of the flight and meteorological data is to provide supporting information for the constituent measurements. However, these data, particularly the wind and temperature measurements, may be of interest even where constituent data are not available, and therefore are reported for all GASP flights.

TROPOPAUSE PRESSURE DATA

The National Meteorological Center (NMC) is presently maintaining a library of gridded meteorological data fields. Among these are tropopause pressures, available on a twice daily basis (0000 and 1200 GMT), gridded into a 37 by 144 array for each hemisphere (2.5 degree intervals in both latitude and longitude).

The tropopause pressure corresponding to each GASP data location is obtained by time and space interpolation from the NMC arrays. These pressures and the corresponding geopotential heights for the standard atmosphere are included in the GASP DATA records (TRPRMB and TRPRHM in table A-II). For normal interpolations (within a 12 hour interval) TPTAG = ' '. If however, NMC data are missing for one reporting period such that the interpolation must be performed within a 24 hour interval, TPTAG = 'L'. If NMC data are missing for two or more consecutive reporting periods the time interpolation is not performed. In this case if the time of the GASP data point is within six hours of an NMC reporting period for which data are available, the space interpolated values at that reporting period are returned and TPTAG = 'E', but if the time of the GASP data point is not within 6 hours of an NMC reporting period for which data are available, TRPRMB = TRPRHM = 0, and TPTAG =

'M'. For GASP records in which the observation time is not available, 1200 GMT has been assumed for tropopause interpolation, and TPTAG = 'T'. Whenever tropopause pressure values are available, DELP = TRPRMB - PAMB, and DELHGT = ALTMAV - TRPRHM are also reported.

Tropopause pressures in the NMC 2-hemisphere arrays are determined by means of the Flattery global analysis method (ref. 42). This procedure makes use of the vertical temperature profiles calculated for each NMC grid point, and tests the slope of the profile curve upwards from the first mandatory pressure level. Although the two hemisphere arrays were not available prior to July 1977, the Flattery analysis scheme was used for tropopause pressures archived in the NMC 65 by 65 arrays prior to December 17, 1975. Tropopause pressures determined by this method have been shown previously to correlate well with GASP constituent data (refs. 9-15).

CONCLUDING REMARKS

Atmospheric constituent data and related flight and meteorological data obtained during flights of GASP-equipped aircraft VH-EBE and N655PA from January 10 through October 2, 1977, and from February 22 through September 23, 1977, respectively, are now available. These data may be obtained on GASP tapes VL0011 and VL0013 from the National Climatic Center, Federal Building, Asheville, NC, 28801. Flight routes and dates, instrumentation, data processing procedures, and data tape specifications and formats are discussed in this report.

REFERENCES

1. Perkins, Porter J.; and Reck, Gregory M.: Atmospheric Constituent Measurements Using Commercial 747 Airliners. NASA TM X-71469, 1973.
2. Reck, Gregory M.; Briebl, Daniel; and Perkins, Porter J.: Flight Test of a Pressurization System Used to Measure Minor Atmospheric Constituents from an Aircraft. NASA TN D-7576, 1974.
3. Reck, Gregory M.; Briebl, Daniel; and Nyland, Ted W.: In Situ Measurements of Arctic Atmospheric Trace Constituents From an Aircraft. NASA TN D-8491, 1977.
4. Briebl, Daniel; and Reck, Gregory M.: Comparison of Ozone Measurement Techniques using Aircraft, Balloon, and Ground-Based Instruments. NASA TM X-3520, 1977.
5. Gauntner, Daniel J.; and Haughney, Louis C.; eds.: Interhemispheric Survey of Minor Upper Atmospheric Constituents During October - November 1976. NASA TM X-73630, 1977.
6. Ranser, Frederick A.; Sellers, Bach; and Briebl, Daniel C.: Ultraviolet Spectrophotometer for Measuring Columnar Atmospheric Ozone from Aircraft. *Appl. Opt.*, vol 17, no. 10, May 1978, pp. 1649-1656.
7. Perkins, Porter J.; and Gustafsson, Ulf R. C.: An Automated Atmospheric Sampling System Operating on 747 Airliners. NASA TM X-71790, 1975.
8. Perkins, P. J.; and Papathakos, L. C.: Global Sensing of Gaseous and Aerosol Trace Species Using Automated Instrumentation on 747 Airliners. NASA TM-73810, 1977.
9. Falconer, Phillip D.; and Holdeman, James D.: Measurements of Atmospheric Ozone Made From a GASP-Equipped 747 Airliner: Mid-March, 1975. *Geophys. Res. Lett.*, vol. 3, no. 2, Feb. 1976, pp. 101-104.
10. Holdeman, James D.; and Falconer, Phillip D.: Analysis of Atmospheric Ozone Measurements Made From a B 747 Airliner During March 1975. NASA TN D-8311, 1976.
11. Falconer, P. D.; Holdeman, J. D.; and Taylor, A. D.: Atmospheric Ozone Measurements Made from B 747 Airliners: Spring 1975. NASA TM X-73675, 1976.

12. Nastrom, G. D.: Variability and Transport of Ozone at the Tropopause from the First Year of GASP Data. (RR-4, Control Data Corp.; NASA Contract NAS2-7807), NASA CR-135176, 1977.
13. Nastrom, G. D.: Vertical and Horizontal Fluxes of Ozone at the Tropopause from the First Year of GASP Data. J. Appl. Meteorol., vol. 16, no. 7, July 1977, pp. 740-744.
14. Gauntner, Daniel J.; et al.: Description and Review of Global Measurements of Atmospheric Species from GASP. NASA TM-73781, 1977.
15. Holdeman, J. D.; Nastrom, G. D.; and Falconer, P. D.: An Analysis of the First Two Years of GASP Data. NASA TM-73817, 1977.
16. Nastrom, G. D.: Variability of Ozone Near the Tropopause from GASP Data. (RR-1, Control Data Corp.; NASA Contract NAS3-20618) NASA CR-135405, 1978.
17. Perkins, Porter J., and Briehl, Daniel: Simultaneous Measurements of Ozone Outside and Inside Cabins of Two B 747 Airliners and a Gates Learjet Business Jet. NASA TM-78983, 1978.
18. Holdeman, J. D.; and Lezberg, E. A.: NASA Global Atmospheric Sampling Program (GASP): Data Report for Tape VL0001. NASA TM X-71905, 1976.
19. Holdeman, James D.; and Lezberg, Erwin A.: NASA Global Atmospheric Sampling Program (GASP): Data Report for Tape VL0002. NASA TM X-73484, 1976.
20. Holdeman, James D.: NASA Global Atmospheric Sampling Program (GASP): Data Report for Tape VL0003. NASA TM X-73506, 1976.
21. Holdeman, J. D.; Humenik, F. M.; and Lezberg, E. A.: NASA Global Atmospheric Sampling Program (GASP): Data Report for Tape VL0004. NASA TM X-73574, 1976.
22. Holdeman, J. D.; and Humenik, F. M.: NASA Global Atmospheric Sampling Program (GASP): Data Report for Tape VL0005. NASA TM X-73608, 1977.

23. Gauntner, Daniel J.; Holdeman, J. D.; and Humenik, Francis M.: NASA Global Atmospheric Sampling Program (GASP): Data Report for Tape VL0006. NASA TM 73727, 1977.
24. Holdeman, J. D.; et al.: NASA Global Atmospheric Sampling Program (GASP): Data Report for Tapes VL0007 and VL0008. NASA TM-73784, 1977.
25. Holdeman, J.D.; et al: NASA Global Atmospheric Sampling Program (GASP): Data Report for Tape VL0009. NASA TM-79058, 1978.
26. Holdeman, J. D.; et al.: NASA Global Atmospheric Sampling Program (GASP): Data Report for Tapes VL0010 and VL0012. NASA TM-79061, 1979.
27. Official Airline Guide, International ed., published monthly, Rueben H. Donnelley Corp.
28. Bowman, Lloyd D.; and Horak, Richard F.: Continuous Ultraviolet Absorption Ozone Photometer. Analysis Instrumentation, Vol. 10, R. L. Chapman, G. A. McNeill, and A. M. Bartz, eds., Instrument Society of America, 1972, pp. 103-108.
29. Tiefermann, Marvin W.: Ozone Measurement System for NASA Global Air Sampling Program. NASA TP-1451, 1979.
30. Saltzman, Bernard E.; and Gilbert, Nathan: Iodometric Microdetermination of Organic Oxidants and Ozone. Anal. Chem., vol. 31, no. 11, Nov. 1959, pp. 1914-1920.
31. DeMore, W. B.; and Patapoff, M.: Comparison of Ozone Determinations by Ultraviolet Photometry and Gas-Phase Titration. Environ. Sci. Technol., vol. 10, no. 9, Sept. 1976, pp. 897-899.
32. Boberg, John E.; and Levine, Myron: Catalytic Filtration of Ozone in Airborne Application. J. Eng. Ind., vol. 84, no. 1, Feb. 1962, pp. 42-48.
33. Ozone Problems in High Altitude Aircraft. Aerospace Information Report 910, Society of Automotive Engineers, Nov. 1965.
34. McMillan, R. D., Jr.: Application of a Precision Ozone Generator in Calibration of Ozone/Oxidant Analyzers and Inlet Sample Air Systems. Anal. Instrum., vol. 10, 1972, pp. 61-66.

35. Dudzinski, Thomas J.: Carbon Monoxide Measurement in the Global Atmospheric Sampling Program. NASA TP-1526, 1979.
36. Gandrud, Bruce W.; and Lazarus, Allan L.: Design of System for Removing Water-Soluble Materials from IPC-1478 Filter Paper. Environ. Sci. Technol., vol. 6, no. 5, May, 1972, pp. 455-457.
37. Small, Hamish; Stevens, Timothy S.; and Bauman, William C.: Novel Ion Exchange Chromatographic Method Using Conductimetric Detection. Anal. Chem., vol. 47, no. 11, Sept. 1975, pp. 1801-1809.
38. Mulik, J.; et al.: Ion Chromatographic Analysis of Sulfate and Nitrate in Ambient Aerosols. Anal. Lett., vol. 9, no. 7, 1976, pp. 653-663.
39. Otterson, Dumas A.: Ion Chromatographic Determination of Anions Collected on Filters at Altitudes Between 9.6 and 13.7 Kilometers. NASA TM X-73642, 1977.
40. Humenik, Francis M.; Lezberg, Erwin A.; and Otterson, Dumas A.: Sulfate and Nitrate Collected by Filter Sampling near the Tropopause. NASA TP-1567, 1980.
41. Woolf, Harold M.: On the Computation of Solar Elevation Angles and the Determination of Sunrise and Sunset Times. NASA TM X-1646, 1968.
42. Flattery, Thomas W.: Spectral Models for Global Analysis and Forecasting. Proceedings of the Sixth Automated Weather Support Technical Exchange Conference. AWS-TR-242. Air Weather Service, 1971, pp. 42-54. (Available from DDC as AD-724093).

TABLE I - GASP DATA ON TAPES VL0001-VL0014

Tape	File	Aircraft	Dates	FLHT*	DATA+	Data**	Ref
VL0001	1	N655PA	3/11/75- 3/30/75	43	1919	O	18
VL0002	1	N4711U	3/23/75- 10/21/75	159	7274	O,W	19
VL0003	1	N655PA	5/02/75- 5/30/75	49	2173	O	20
VL0004	1	N4711U	12/26/75- 3/07/76	73	3572	O,W,F	21
"	2	N655PA	1/22/76- 3/25/76	66	3757	O,F,B	21
VL0005	1	N4711U	3/29/76- 5/29/76	100	4892	O,W	22
"	2	N655PA	3/25/76- 5/13/76	86	4716	O,B	22
"	3	N533PA	4/13/76- 6/13/76	28	2640	O,B	22
VL0006	1	N655PA	7/11/76- 9/26/76	131	8724	O,F,B	23
"	2	N533PA	7/08/76- 9/14/76	45	3594	O,B	23
"	3	VH-EBF	7/13/76- 8/31/76	69	3977	O	23
VL0007	1	N712NA	10/28/76-11/18/76	14	3481	O	24
"	2	N4711U	11/24/76-12/30/76	75	3756	O,F	24
"	3	N533PA	9/30/76- 1/02/77	146	13773	O,W	24
VL0008	1	N655PA	10/15/76- 1/10/77	165	10122	F	24
"	2	VH-ESE	9/26/76- 1/09/77	286	15525		24
VL0009	1	N533PA	10/28/77-10/29/77	1	9162	O,C,A,P,Z	25
"	2	N533PA	10/29/77-10/29/77	1	8890	O,C,A,P,Z	25
"	3	N533PA	10/29/77-10/30/77	1	11487	O,C,A,P,Z	25
"	4	N533PA	10/30/77-10/31/77	1	9640	O,C,A,P,Z	25
VL0010	1	N533PA	1/21/77- 4/ 3/77	66	6586	O,W,P	26
"	2	N533PA	4/ 6/77- 5/31/77	99	7355	O,C,P,Z	26
"	3	N533PA	6/ 1/77- 6/ 2/77	2	3633	O,C,P,Z	26
"	4	N533PA	6/ 3/77- 8/12/77	96	10643	O,C,P,Z	26
"	5	N533PA	8/13/77-10/ 4/77	73	7875	O,C,P	26

TABLE I - GASP DATA ON TAPES VL0001-VL0014 CONCLUDED

Tape	File	Aircraft	Dates	FLHT*	DATA†	Data**	Ref
VL0011	1	VH-EBE	1/10/77- 2/28/77	127	6314	O, P	--
"	2	VH-EBE	3/15/77- 4/23/77	120	6807	O, C	--
"	3	VH-EBE	4/24/77- 6/18/77	144	6381	O, C	--
"	4	VH-EBE	6/18/77- 8/12/77	131	6264	O, C	--
"	5	VH-EBE	8/15/77- 10/ 2/77	124	6094	O, C	--
VL0012	1	N4711U	1/ 3/77- 3/25/77	49	2181	O, F	26
"	2	N4711U	3/26/77- 6/13/77	102	4669	O, C, Z, F	26
"	3	N4711U	6/14/77- 7/26/77	93	4418	C, Z	26
"	4	N4711U	7/27/77- 9/20/77	110	4394	F	26
VL0013	1	N655PA	2/22/77- 4/ 9/77	84	4058	--	
"	2	N655PA	4/15/77- 6/14/77	126	6084	O, C	--
"	3	N655PA	6/14/77- 7/ 8/77	73	3321	O	--
"	4	N655PA	7/ 8/77- 9/ 1/77	119	5555	F	--
"	5	N655PA	9/ 2/77- 10/ 5/77	74	3273	F	--
VL0014	1	N533PA	10/ 4/77- 1/ 3/78	109	9718	O, W, C, P, A, Z	
"	2	N4711U	11/ 6/77- 1/ 5/78	138	5836	C, A, Z, F	
"	3	N655PA	10/ 5/77- 12/18/77	99	4824	O, C, P, F	
"	4	VH-EBE	10/ 3/77- 11/19/77	96	4334	O, C	
"	5	VH-EBE	11/20/77- 1/ 4/78	120	5931	O, W, C	
				3913	269622		

* Number of flights

† Number of DATA records

** Constituent measurements:

O - Ozone
 W - Water vapor
 F - Filter data
 B - Sample bottle data
 C - Carbon monoxide
 A - Condensation nuclei
 P - Particles and/or clouds
 Z - Cabin ozone

TABLE II - FLIGHTS ON GASP TAPE VL0011

A) FILE 1 (QANTAS VH-EBE)

	FLIGHT	ROUTE	DEPARTURE DATE	DATA TIME	DATA * INTVL (GMT)
1	GP181	SYD-SIN	1/10/77	0602-1241	129
2	"	SIN-KUL	1/10/77	1442-1447	2
3	"	KUL-BAH	1/10/77	1635-2315	78
4	"	BAH-BEG	1/11/77	0114-0519	49
5	"	BEG-LHR	1/11/77	0705-0855	23
6	"	LHR-AMS	1/11/77	1758-1803	2
7	"	AMS-BAH	1/11/77	2023-0136	79
8	"	BAH-KUL	1/12/77	0425-1010	69
9	"	KUL-SIN	1/12/77	1154-1159	2
10	"	SIN-SYD	1/12/77	1358-2033	76
11	"	SYD-NAN	1/13/77	1031-1325	34
12	"	NAN-HNL	1/13/77	1512-2027	62
13	"	HNL-SFO	1/13/77	2251-0239	45
14	"	SFO-HNL	1/14/77	0520-0940	52 O
15	"	HNL-NAN	1/14/77	1142-1657	63 O
16	"	NAN-SYD	1/14/77	1900-2220	86 O
17	"	SYD-NAN	1/15/77	0223-0523	34 O
18	"	NAN-SYD	1/15/77	0707-1034	75 O
19	"	SYD-SIN	1/16/77	0619-1309	80 O
20	"	SIN-BKK	1/16/77	1507-1627	15 O
21	"	BKK-BAH	1/16/77	1806-0046	80 O
22	"	BAH-FRA	1/17/77	0237-0752	63 O
23	"	FRA-LHR	1/17/77	1056-1151	11 O
24	"	LHR-BOM	1/17/77	1545-2320	88 O
25	"	BOM-PER	1/18/77	0123-0848	87 O
26	"	PER-SYD	1/18/77	1554-1849	35 O
27	GP186	SYD-SIN	1/19/77	0602-1242	79 O P
28	"	SIN-KUL	1/19/77	1443-1443	1
29	"	KUL-BAH	1/19/77	1626-2321	98 O P
30	"	BAH-FRA	1/20/77	0101-0621	64 O P
31	"	FRA-LHR	1/20/77	0824-0854	7 O P
32	"	LHR-AMS	1/20/77	1759-1804	2
33	"	AMS-ATH	1/20/77	2012-2245	28 O P
34	"	ATH-BAH	1/21/77	0031-0321	35 O P
35	"	BAH-SIN	1/21/77	0459-1113	90 O P
36	"	SIN-SYD	1/21/77	1356-2011	73 O P
37	"	SYD-MEL	1/21/77	2236-2311	8 O P
38	"	MEL-SYD	1/22/77	0325-0350	6 O P
39	"	SYD-PER	1/23/77	0612-0957	45 O
40	"	PER-BOM	1/23/77	1148-1926	99 O P
41	"	BOM-LHR	1/23/77	2143-0713	110 O P
42	"	LHR-BOM	1/24/77	1210-1935	87 O P
43	"	BOM-PER	1/24/77	2136-0513	90 O P
44	"	PER-SYD	1/25/77	0704-1006	59 O P
45	"	SYD-MEL	1/26/77	2150-2220	6 O P

TABLE II - A) VL0011 FILE 1 CONTINUED....

		FLIGHT ROUTE	DEPARTURE DATE	DATA TIME INTVL (GMT)	DATA *
46	GP186	MEL-PER	1/27/77	0004-0304	37 O P
47	"	PER-MRU	1/27/77	0518-1108	71 O P
48	"	MRU-JNB	1/27/77	1306-1605	47 O P
49	"	JNB-MRU	1/28/77	1526-1823	36 O P
50	"	MRU-PER	1/28/77	2013-0158	68 O P
51	"	PER-MEL	1/29/77	0356-0631	31 O P
52	"	MEL-SYD	1/29/77	0800-0835	8 O P
53	"	SYD-SIN	1/30/77	0756-1424	75 O P
54	"	SIN-BKK	1/30/77	1614-1729	16 O P
55	"	BKK-BAH	1/30/77	1914-0115	69 O P
56	"	BAH-FRA	1/31/77	0320-0900	67 O P
57	"	FRA-LHR	1/31/77	1046-1121	8 O
58	"	LHR-FRA	1/31/77	1817-1841	5 O
59	"	FRA-BAH	1/31/77	2101-0131	67 O P
60	"	BAH-BKK	2/ 1/77	0334-0849	63 O P
61	"	BKK-SIN	2/ 1/77	1026-1146	17
62	"	SIN-SYD	2/ 1/77	1410-2020	90 O P
63	"	SYD-MEL	2/ 1/77	2248-2318	7
64	"	MEL-SYD	2/ 2/77	0319-0349	7
65	"	SYD-MEL	2/ 2/77	2122-2157	8
66	"	MEL-PER	2/ 2/77	2344-0244	36 O P
67	"	PER-MRU	2/ 3/77	0456-1101	72
68	"	MRU-JNB	2/ 3/77	1300-1606	79
69	"	JNB-MRU	2/ 4/77	1439-1745	68
70	"	MRU-PER	2/ 4/77	1951-0138	70 O P
71	"	PER-MEL	2/ 5/77	0335-0604	29
72	"	MEL-SYD	2/ 5/77	0735-0845	15
73	GP190	SYD-AKL	2/ 6/77	0204-0404	24 O P
74	"	AKL-SYD	2/ 6/77	0600-0802	47 O P
75	"	SYD-NAN	2/11/77	1042-1340	124 O P
76	"	NAN-HNL	2/11/77	1523-2038	61 O P
77	"	HNL-SFO	2/11/77	2233-0213	42 O P
78	"	SFO-HNL	2/12/77	0525-0940	52 O P
79	"	HNL-NAN	2/12/77	1139-1649	61 O P
80	"	NAN-SYD	2/12/77	1856-2210	39 O P
81	"	SYD-SIN	2/13/77	0635-1309	90 O P
82	"	SIN-BKK	2/13/77	1446-1601	15 O P
83	"	BKK-BAH	2/13/77	1741-2332	67 O P
84	"	BAH-FRA	2/14/77	0140-0629	83 O P
85	"	FRA-LHR	2/14/77	0910-0940	7 O P
86	"	LHR-FRA	2/14/77	1758-1818	5 O P
87	"	FRA-BAH	2/14/77	2047-0147	61 O P
88	"	BAH-BKK	2/15/77	0341-0921	65 O P
89	"	BKK-SIN	2/15/77	1038-1203	17 O P
90	"	SIN-SYD	2/15/77	1357-2025	107 O P

TABLE II - A) VL0011 FILE 1 CONTINUED....

	FLIGHT ROUTE	DEPARTURE DATE	DATA TIME INTVL (GMT)	DATA *
91	GP190 SYD-MEL	2/15/77	2247-2317	7 O P
92	" MEL-SYD	2/16/77	0318-0348	6 O P
93	" SYD-MEL	2/16/77	2132-2202	7 O P
94	" MEL-PER	2/16/77	2345-0240	36 O P
95	" PER-MRU	2/17/77	0504-1118	144 O P
96	" MRU-JNB	2/17/77	1256-1551	31 O P
97	" JNB-MRU	2/18/77	1423-1728	36 O P
98	" MRU-PER	2/18/77	1918-0058	68 O P
99	" PER-MEL	2/19/77	0256-0526	31 O P
100	" MEL-SYD	2/19/77	0700-0730	7 O P
101	" SYD-NAN	2/19/77	1026-1326	36 O P
102	" NAN-HNL	2/19/77	1508-2035	93 O P
103	" HNL-SFO	2/19/77	2249-0227	60 O P
104	" SFO-HNL	2/20/77	0521-0950	124 O P
105	" HNL-NAN	2/20/77	1135-1650	62 O P
106	" NAN-SYD	2/20/77	1850-2225	42 O P
107	" SYD-MEL	2/21/77	0227-0252	6 O P
108	" MEL-SIN	2/21/77	0439-1109	76 O P
109	" SIN-BKK	2/21/77	1333-1449	32 O P
110	" BKK-THR	2/21/77	1638-2327	93 O P
111	" THR-ATH	2/22/77	0122-0440	55 O P
112	" ATH-FCO	2/22/77	0608-0723	15 O P
113	" FCO-ATH	2/22/77	1839-1924	6
114	" ATH-THR	2/22/77	2129-0014	34 O P
115	" THR-BKK	2/23/77	0206-0717	108 O P
116	" BKK-SIN	2/23/77	0915-1030	16 O P
117	" SIN-MEL	2/24/77	1008-1638	76 O P
118	" MEL-SYD	2/24/77	1843-1916	58 O P
119	GP195 SYD-MNL	2/26/77	0130-0756	76 O
120	" MNL-HKG	2/26/77	0948-1048	13 O
121	" HKG-MNL	2/26/77	1253-1353	12 O
122	" MNL-SYD	2/26/77	1539-2223	116 O
123	" SYD-CHC	2/27/77	0311-0506	24 O
124	" CHC-SYD	2/27/77	0723-0933	26 O
125	" SYD-NAN	2/28/77	1034-1328	36 O
126	" NAN-HNL	2/28/77	1511-2021	60 O
127	" HNL-SFO	2/28/77	2231-0221	47 O

* Number of DATA records in flight

O - OZONE

P - PARTICLES AND/OR CLOUDS

TABLE II - FLIGHTS ON GASP TAPE VL0011

B) FILE 2 (QANTAS VH-EBE)

	FLIGHT	DEPARTURE	DATA TIME	DATA
	ROUTE	DATE	INTVL (GMT)	*
1	GP200 SFO-HNL	3/15/77	0522-0932	48
2	" HNL-NAN	3/15/77	1141-1704	79
3	" NAN-SYD	3/15/77	1909-2224	40
4	" SYD-DRW	3/16/77	0626-0943	112
5	" DRW-BKK	3/16/77	1132-1617	56
6	" BKK-THR	3/16/77	1835-0049	73
7	" THR-ATH	3/17/77	0310-0618	102
8	" ATH-BEG	3/17/77	0809-0849	9
9	" BEG-ORY	3/17/77	1014-1139	18
10	" ORY-BEG	3/17/77	1646-1802	16
11	" BEG-ATH	3/17/77	1937-2012	7
12	" ATH-DAM	3/17/77	2213-2338	33
13	" DAM-BKK	3/18/77	0203-0900	81
14	" BKK-DRW	3/18/77	1113-1608	59
15	" DRW-SYD	3/18/77	1814-2120	54
16	" SYD-NAN	3/19/77	1025-1326	106
17	" NAN-HNL	3/19/77	1512-2027	58
18	" HNL-SFO	3/19/77	2253-0258	61
19	" SFO-HNL	3/20/77	0533-0923	46
20	" HNL-NAN	3/20/77	1138-1706	137
21	" NAN-SYD	3/20/77	1858-2223	40
22	" SYD-NAN	3/21/77	1025-1325	34
23	" NAN-HNL	3/21/77	1515-2015	168
24	" HNL-SFO	3/21/77	2233-0233	62
25	GP214 SFO-HNL	3/22/77	0524-0927	122 C
26	" HNL-NAN	3/22/77	1130-1658	83 C
27	" NAN-SYD	3/22/77	1859-2214	37 C
28	" SYD-MEL	3/23/77	2124-2159	8
29	" MLL-PER	3/23/77	2352-0307	40 O C
30	" PER-MRU	3/24/77	0510-1106	83 O C
31	" MRU-JNB	3/24/77	1258-1603	38 O C
32	" JNB-MRU	3/25/77	1458-1757	109 O C
33	" MRU-PER	3/25/77	1944-0124	67 O C
34	" PER-MEL	3/26/77	0309-0539	30 O C
35	" MEL-SYD	3/26/77	0712-0742	7 O
36	" SYD-SIN	3/27/77	0612-1253	95 C
37	" SIN-BKK	3/27/77	1442-1557	13
38	" BKK-BAH	3/27/77	1750-2342	89 C
39	" BAH-FRA	3/28/77	0505-1025	60 C
40	" FRA-LHR	3/28/77	1219-1254	8
41	" LHR-FRA	3/28/77	1840-1910	7
42	" FRA-BAH	3/28/77	2059-0211	78 C
43	" BAH-BKK	3/29/77	0357-0916	79 C
44	" BKK-SIN	3/29/77	1039-1159	16 C
45	" SIN-SYD	3/29/77	1417-2032	75 C

TABLE II - B) VL0011 FILE 2 CONTINUED....

	FLIGHT ROUTE	DEPARTURE DATE	DATA TIME INTVL (GMT)	DATA *
46	GP214 SYD-SYD	3/29/77	2253-2306	32
47	" SYD-MEL	3/30/77	0056-0136	9
48	" MEL-SYD	3/30/77	0000-0000M	6
49	" SYD-DRW	3/30/77	0000-0000M	37
50	" DRW-BKK	3/30/77	0000-0000M	54
51	" BKK-THR	3/30/77	0000-0000M	163
52	" THR-ATH	3/31/77	0000-0000M	84
53	" ATH-BEG	3/31/77	0000-0000M	7
54	" BEG-FRA	3/31/77	0000-0000M	13
55	" FRA-BEG	3/31/77	0000-0000M	10
56	" BEG-ATH	3/31/77	0000-0000M	125
57	" ATH-DAM	3/31/77	0000-0000M	29
58	" DAM-BKK	4/ 1/77	0000-0000M	101
59	" BKK-DRW	4/ 1/77	0000-0000M	59
60	" DRW-SYD	4/ 1/77	0000-0000M	67
61	" SYD-NAN	4/ 2/77	0000-0000M	34
62	" NAN-SYD	4/ 2/77	0000-0000M	42
63	" SYD-MEL	4/ 3/77	0410-0445	8
64	" MEL-PER	4/ 3/77	0622-0912	32
65	" PER-BOM	4/ 3/77	1119-1909	92
66	" BOM-LHR	4/ 3/77	2112-0542	98
67	" LHR-BOM	4/ 4/77	1019-1804	88
68	" BOM-PER	4/ 4/77	1951-0321	87
69	" PER-MEL	4/ 5/77	0523-0748	29
70	" MEL-SYD	4/ 5/77	0945-1010	6
71	" SYD-PER	4/ 5/77	2137-0137	49
72	" PER-BOM	4/ 6/77	0428-1208	90
73	" BOM-LHR	4/ 6/77	1401-2238	142
74	" LHR-BOM	4/ 7/77	0911-1641	90
75	" BOM-PER	4/ 7/77	1850-0226	110
76	" PER-SYD	4/ 8/77	0406-0721	39
77	GP222 SYD-HNL	4/ 8/77	1056-1913	149 O C
78	" HNL-SFO	4/ 8/77	2138-0128	47 O C
79	" SFO-HNL	4/ 9/77	0542-0952	50 O C
80	" HNL-SYD	4/ 9/77	1152-2057	106 O C
81	" SYD-HNL	4/10/77	0739-1546	142 O C
82	" HNL-SFO	4/10/77	1745-2130	45 O C
83	" SFO-YVR	4/10/77	2305-0015	15 O C
84	" YVR-SFO	4/11/77	0210-0320	15 O C
85	" SFO-HNL	4/11/77	0523-0933	51 O C
86	" HNL-SYD	4/11/77	2040-0609	129 O C
87	" SYD-HNL	4/13/77	1057-1856	124 O C
88	" HNL-SFO	4/13/77	2151-0208	53 O C
89	" SFO-HNL	4/14/77	0527-0919	46 O C
90	" HNL-NAN	4/14/77	1134-1648	64 O C

TABLE II - B) VL0011 FILE 2 CONTINUED....

	FLIGHT	DEPARTURE	DATA TIME	DATA
	ROUTE	DATE	INTVL (GMT)	*
91	GP222 NAN-SYD	4/14/77	1836-2211	43 O C
92	" SYD-AKL	4/15/77	0142-0347	25 O C
93	" AKL-SYD	4/15/77	0555-0815	28 O C
94	" SYD-HNL	4/15/77	1127-1936	130 O C
95	" HNL-SFO	4/15/77	2158-0148	44 O C
96	" SFO-HNL	4/16/77	0528-0943	42 O C
97	" HNL-SYD	4/16/77	1206-2113	108 O C
98	" SYD-CHC	4/17/77	0154-0355	25 O C
99	" CHC-SYD	4/17/77	0624-0834	27 O C
100	" SYD-NAN	4/18/77	0933-1222	34 O C
101	" NAN-HNL	4/18/77	1409-1915	61 O C
102	" HNL-SFO	4/18/77	2141-0126	45 O C
103	" SFO-HNL	4/19/77	0518-0934	51 O C
104	" HNL-NAN	4/19/77	1141-1706	65 O C
105	" NAN-SYD	4/19/77	1911-2241	42 O C
106	" SYD-DRW	4/20/77	0646-1021	42 O C
107	" DRW-BKK	4/20/77	1214-1703	58 O C
108	" BKK-THR	4/20/77	1900-0110	72 O C
109	" THR-ATH	4/21/77	0306-0626	39 O C
110	" ATH-BEG	4/21/77	0838-0918	9 O
111	" BEG-FRA	4/21/77	1111-1211	13 O
112	" FRA-LHR	4/21/77	1634-1702	7 O
113	" LHR-BEG	4/21/77	1910-2045	20 O C
114	" BEG-ATH	4/21/77	2210-2250	9 O
115	" ATH-DAM	4/22/77	0048-0158	15 O C
116	" DAM-BKK	4/22/77	0353-1038	79 O C
117	" BKK-DRW	4/22/77	1237-1727	56 O C
118	" DRW-SYD	4/22/77	2007-2302	34 C
119	" SYD-NAN	4/23/77	0122-0407	34 O C
120	" NAN-SYD	4/23/77	0606-0926	39 O C

* Number of DATA records in flight

C - OZONE

C - CARBON MONOXIDE

TABLE II - FLIGHTS ON GASP TAPE VL0011

C) FILE 3 (QANTAS VH-EBE)

	FLIGHT	ROUTE	DEPARTURE DATE	DATA TIME INTVL (GMT)	DATA *
1	GP227	SYD-MEL	4/24/77	0411-0441	6 0
2	"	MEL-PER	4/24/77	0623-0858	32 0 C
3	"	PER-BOM	4/24/77	1130-1919	107 0 C
4	"	BOM-LHR	4/24/77	2138-0624	149 0 C
5	"	LHR-BOM	4/25/77	1029-1749	135 0 C
6	"	BOM-PER	4/25/77	1953-0328	88 0 C
7	"	PER-MEL	4/26/77	0514-0744	31 0 C
8	"	MEL-SYD	4/26/77	0923-0948	6 0
9	"	SYD-SIN	4/27/77	0605-1253	81 0 C
10	"	KUL-BAH	4/27/77	1711-2335	75 0 C
11	"	BAH-ORY	4/28/77	0138-0659	158 0 C
12	"	ORY-LHR	4/28/77	0845-0850	2
13	"	LHR-AMS	4/28/77	1804-1814	3
14	"	AMS-VIE	4/28/77	2016-2106	11 0
15	"	VIE-BAH	4/28/77	2244-0320	56 0 C
16	"	BAH-SIN	4/29/77	0532-1147	73 0 C
17	"	SIN-SYD	4/29/77	1422-2027	70 0 C
18	"	SYD-MEL	4/29/77	2240-2315	7 0
19	"	MEL-SYD	4/30/77	0322-0352	6 0
20	"	SYD-NAN	4/30/77	0931-1220	34 0 C
21	"	NAN-HNL	4/30/77	1414-1918	100 0 C
22	"	HNL-SFO	4/30/77	2149-0134	46 0 C
23	"	SFO-HNL	5/ 1/77	0419-0829	48 0 C
24	"	HNL-NAN	5/ 1/77	1038-1603	63 0 C
25	"	NAN-SYD	5/ 1/77	1756-2132	59 0 C
26	"	SYD-AKL	5/ 2/77	0107-0308	25 0 C
27	"	AKL-SYD	5/ 2/77	0523-0743	29 0 C
28	"	SYD-MEL	5/ 3/77	0411-0446	8 0
29	"	MEL-PER	5/ 3/77	0631-0925	50 0 C
30	"	PER-BOM	5/ 3/77	1120-1856	123 0 C
31	"	BOM-LHR	5/ 3/77	2120-0550	98 0 C
32	"	LHR-BOM	5/ 4/77	1009-1749	90 0 C
33	"	BOM-PER	5/ 4/77	1943-0318	87 0 C
34	"	PER-MEL	5/ 5/77	0524-0805	62 0 C
35	"	MEL-SYD	5/ 5/77	0936-1011	8 0
36	"	SYD-NAN	5/ 6/77	0156-0447	66 0 C
37	"	NAN-SYD	5/ 6/77	0643-1033	44 0 C
38	GP229	SYD-HKG	5/13/77	0552-1355	128 0 C
39	"	HKG-SYD	5/13/77	1556-2331	87 0 C
40	"	SYD-MEL	5/14/77	0357-0427	7 0
41	"	MEL-SIN	5/14/77	0623-1248	75 0 C
42	"	SIN-BKK	5/14/77	1442-1557	15 0 C
43	"	BKK-DAM	5/14/77	1751-0116	86 0 C
44	"	DAM-ATH	5/15/77	0301-0421	17
45	"	ATH-FCO	5/15/77	0607-0717	30

TABLE II - C) VL0011 FILE 3 CONTINUED....

		FLIGHT ROUTE	DEPARTURE DATE	DATA TIME INTVL (GMT)	DATA *
46	GP229	FCO-ATH	5/15/77	1844-1944	13
47	"	ATH-THR	5/15/77	2202-0036	60
48	"	THR-BKK	5/16/77	0240-0815	68
49	"	BKK-SIN	5/16/77	1012-1127	14
50	"	SIN-MEL	5/16/77	1348-1940	87
51	"	MEL-SYD	5/16/77	2200-2230	7
52	"	SYD-AKL	5/18/77	0102-0258	23
53	"	AKL-SYD	5/18/77	0506-0731	28
54	"	SYD-HNL	5/18/77	1104-1925	171
55	"	HNL-SFO	5/18/77	2145-0135	46
56	GP234	SFO-HNL	5/19/77	0430-0841	60
57	"	HNL-SYD	5/19/77	1052-2004	120
58	"	SYD-MEL	5/20/77	0553-0628	7
59	"	MEL-SIN	5/20/77	0832-1528	93
60	"	SIN-BKK	5/20/77	1715-1835	15
61	"	BKK-BAH	5/20/77	2012-0202	67
62	"	BAH-FRA	5/21/77	0433-0918	54
63	"	FRA-LHR	5/21/77	1114-1139	5
64	"	LHR-FRA	5/21/77	0000-0000M	7
65	"	FRA-BAH	5/21/77	0000-0000M	63
66	"	BAH-BKK	5/22/77	0000-0000M	58
67	"	BKK-SIN	5/22/77	0000-0000M	16
68	"	SIN-MEL	5/22/77	1415-1950	61
69	"	MEL-SYD	5/22/77	2143-2218	8
70	"	SYD-MEL	5/23/77	0610-0650	9
71	"	MEL-SIN	5/23/77	0858-1606	82
72	"	SIN-KUL	5/23/77	1746-1751	2
73	"	KUL-BAH	5/23/77	1929-0153	82
74	"	BAH-BEG	5/24/77	0342-0737	43
75	"	BEG-LHR	5/24/77	0905-1050	20
76	"	LHR-AMS	5/24/77	1759-1804	2
77	"	AMS-BAH	5/24/77	2010-0117	63
78	"	BAH-KUL	5/25/77	0315-0923	92
79	"	KUL-SIN	5/25/77	1058-1108	3
80	"	SIN-SYD	5/25/77	1341-1941	70
81	"	SYD-MEL	5/25/77	2223-2258	8
82	"	MEL-SYD	5/26/77	0321-0351	7
83	"	SYD-SIN	5/26/77	0602-1338	87
84	"	SIN-BAH	5/26/77	1615-2250	77
85	"	BAH-VIE	5/27/77	0048-0523	50
86	"	VIE-AMS	5/27/77	0655-0744	20
87	"	AMS-LHR	5/27/77	0947-0952	2
88	"	LHR-FRA	5/27/77	1815-1840	6
89	"	FRA-BAH	5/27/77	2103-0141	65
90	"	BAH-KUL	5/28/77	0341-0956	73

TABLE II - C) VL0011 FILE 3 CONTINUED....

		FLIGHT ROUTE	DEPARTURE DATE	DATA TIME INTVL (GMT)	DATA *
91	GP234	KUL-SIN	5/28/77	1137-1142	2
92	"	SIN-SYD	5/28/77	1411-2025	77
93	"	SYD-MEL	5/28/77	2237-2312	8
94	"	MEL-SYD	5/29/77	0319-0349	7
95	"	SYD-SIN	5/29/77	0801-1501	80
96	"	SIN-BKK	5/29/77	1639-1755	26
97	"	BKK-BAH	5/29/77	1939-0129	59
98	"	BAH-FRA	5/30/77	0335-0839	59
99	"	FRA-LHR	5/30/77	1233-1303	7
100	"	LHR-ORY	5/30/77	1803-1808	2
101	"	ORY-BAH	5/30/77	2027-0122	56
102	"	BAH-BKK	5/31/77	1745-2231	62
103	"	BKK-SIN	6/ 1/77	0008-0128	16
104	"	SIN-SYD	6/ 1/77	0324-1004	77
105	GP240	SYD-NAN	6/ 4/77	0934-1220	25 O C
106	"	NAN-HNL	6/ 4/77	1419-1922	22 O C
107	"	HNL-SFO	6/ 4/77	2142-0122	11 O C
108	"	SFO-HNL	6/ 5/77	0512-0923	33 O C
109	"	HNL-NAN	6/ 5/77	1113-1623	40 O C
110	"	NAN-SYD	6/ 5/77	1813-2133	18 O C
111	"	NAN-HNL	6/ 6/77	1713-1938	24 O C
112	"	HNL-SFO	6/ 6/77	2159-0145	41 O C
113	"	SFO-HNL	6/ 7/77	0421-0832	43 O C
114	"	HNL-NAN	6/ 7/77	1048-1603	34 O C
115	"	NAN-SYD	6/ 7/77	1813-2128	19 O C
116	"	SYD-AKL	6/ 8/77	0335-0415	6 O C
117	"	AKL-SYD	6/ 8/77	0607-0822	27 O C
118	"	SYD-MEL	6/ 9/77	0000-0000M	6 O
119	"	MEL-SIN	6/ 9/77	0000-0000M	119 O C
120	"	SIN-BKK	6/ 9/77	0000-0000M	15 O
121	"	BKK-THR	6/ 9/77	0000-0000M	65 O C
122	"	THR-ATH	6/10/77	0000-0000M	36 O C
123	"	ATH-FCO	6/10/77	0000-0000M	14 O
124	"	FCO-ATH	6/10/77	1853-1948	12 O
125	"	ATH-THR	6/10/77	2134-0009	31 O C
126	"	THR-BKK	6/11/77	0206-0743	89 O C
127	"	BKK-SIN	6/11/77	0939-1059	17 O
128	"	SIN-MEL	6/11/77	1312-1921	69 O C
129	"	MEL-SYD	6/11/77	2106-2136	7 O
130	"	SYD-HNL	6/12/77	0537-1353	97 O C
131	"	HNL-SFO	6/12/77	1614-2002	30 O C
132	"	SFO-YVR	6/12/77	2229-2309	6
133	"	YVR-SFO	6/13/77	0136-0156	2
134	"	SFO-HNL	6/13/77	0440-0845	35 O C
135	"	HNL-SYD	6/13/77	1106-1956	72 O C

TABLE II - C) VL0011 FILE 3 CONTINUED....

	FLIGHT	DEPARTURE	DATA TIME	DATA
	ROUTE	DATE	INTVL (GMT)	*
136	GP240 SYD-AKL	6/15/77	0122-0302	15 O C
137	" AKL-SYD	6/15/77	0509-0729	18
138	" MEL-PER	6/16/77	0102-0307	14 O C
139	" PER-SIN	6/16/77	0658-0913	10 O C
140	" SIN-MRU	6/16/77	1226-1631	31 O C
141	" MRU-JNB	6/16/77	1807-2142	30 O C
142	" MRU-PER	6/17/77	2106-0016	32 O C
143	" PER-MEL	6/18/77	0225-0505	26 O C
144	" MEL-DEL	6/18/77	0629-0659	7 O

* Number of DATA records in flight

O - OZONE

C - CARBON MONOXIDE

TABLE II - FLIGHTS ON GASP TAPE VL0011

D) FILE 4 (QANTAS VH-EBE)

		FLIGHT ROUTE	DEPARTURE DATE	DATA TIME INTVL (GMT)	DATA *
1	GP244	SYD-NAN	6/18/77	0946-1221	42 O C
2	"	NAN-HNL	6/18/77	1411-1927	63 O C
3	"	HNL-SFO	6/18/77	2202-0158	56 O C
4	"	SFO-HNL	6/19/77	0439-0844	46 O C
5	"	HNL-NAN	6/19/77	1046-1601	60 O C
6	"	NAN-SYD	6/19/77	1807-2148	52 C
7	"	SYD-AKL	6/20/77	0057-0302	26 O C
8	"	AKL-SYD	6/20/77	0505-0724	36 O C
9	"	SYD-MEL	6/21/77	0000-0000M	3 O
10	"	MEL-SIN	6/21/77	0000-0000M	70 O C
11	"	SIN-BAH	6/21/77	0000-0000M	52 O C
12	"	BAH-BEG	6/22/77	0000-0000M	19 O C
13	"	BEG-VIE	6/22/77	0000-0000M	3 O
14	"	VIE-FRA	6/22/77	0000-0000M	4 O
15	"	FRA-BEG	6/22/77	1721-1922	6
16	"	BEG-BAH	6/22/77	2148-0043	26 O C
17	"	BAH-SIN	6/23/77	0311-0956	70 O C
18	"	SIN-MEL	6/23/77	1215-1834	73 O C
19	"	MEL-SYD	6/23/77	2019-2050	19 O
20	"	SYD-MEL	6/24/77	0000-0000M	7 O
21	"	MEL-PER	6/24/77	0000-0000M	38 C
22	"	PER-BOM	6/24/77	0000-0000M	114 O C
23	"	BOM-AMS	6/24/77	0000-0000M	105 O C
24	"	AMS-LHR	6/25/77	0000-0000M	3 O
25	"	LHR-BOM	6/25/77	1418-2142	129 O C
26	"	BOM-PER	6/26/77	0006-0716	82 O
27	"	PER-SYD	6/26/77	0920-1205	30 O
28	"	SYD-NAN	7/ 2/77	0022-0312	29 O
29	"	NAN-SYD	7/ 2/77	0523-0858	42 O C
30	"	SYD-MEL	7/ 3/77	0411-0447	7 O
31	"	MEL-PER	7/ 3/77	0621-0916	29 O C
32	"	PER-BOM	7/ 3/77	1121-1858	108 O C
33	"	BOM-LHR	7/ 3/77	2122-0527	79 O C
34	"	LHR-BOM	7/ 4/77	1039-1815	72 O C
35	"	BOM-PER	7/ 4/77	2017-0343	67 O C
36	"	PER-MEL	7/ 5/77	0540-0814	40 O
37	"	MEL-SYD	7/ 5/77	0943-1008	6 O
38	GP255	SYD-MEL	7/ 8/77	2222-2252	7 O
39	"	MEL-SYD	7/ 9/77	0320-0350	7 O
40	"	SYD-NAN	7/ 9/77	0927-1222	55 O
41	"	NAN-HNL	7/ 9/77	1418-1939	117 O
42	"	HNL-SFO	7/ 9/77	2142-0127	44 O
43	"	SFO-HNL	7/10/77	0424-0834	49 O
44	"	HNL-NAN	7/10/77	1036-1546	60 O
45	"	NAN-SYD	7/10/77	1805-2140	42 O

TABLE II - D) VL0011 FILE 4 CONTINUED....

	FLIGHT ROUTE	DEPARTURE DATE	DATA TIME INTVL (GMT)	DATA *
46	GP255 SYD-SIN	7/12/77	0556-1241	59 0
47	" SIN-BAH	7/12/77	1506-2051	42 0
48	" BAH-LHR	7/13/77	0305-0505	22 0
49	" LHR-BAH	7/13/77	2114-0229	13 0
50	" BAH-SIN	7/14/77	0500-1134	75 0
51	" SIN-SYD	7/14/77	1351-2002	71 0
52	" SYD-MEL	7/15/77	0312-0347	8 0
53	" MEL-SIN	7/15/77	0540-1200	74 0
54	" SIN-BKK	7/15/77	1439-1554	16 0
55	" BKK-ATH	7/15/77	1751-0226	97 0
56	" ATH-BEG	7/16/77	0512-0552	9 0
57	" BEG-FRA	7/16/77	0726-0821	12 0
58	" FRA-BEG	7/16/77	1650-1743	25 0
59	" BEG-ATH	7/16/77	1926-2006	9 0
60	" ATH-BKK	7/16/77	2247-0706	110 0
61	" BKK-SIN	7/17/77	0846-1001	15 0
62	" SIN-SYD	7/17/77	1215-1840	77 0
63	" SYD-AKL	7/18/77	0056-0251	24 0
64	" AKL-SYD	7/18/77	0507-0732	29 0
65	" SYD-HKG	7/19/77	0237-1025	142 0
66	" HKG-MNL	7/19/77	1330-1431	32 0
67	" MNL-SYD	7/19/77	0000-0000M	78 0
68	" SYD-MEL	7/20/77	0000-0000M	8 0
69	" MEL-PER	7/20/77	0000-0000M	40 0
70	" PER-BOM	7/20/77	0000-0000M	30 0
71	" BOM-LHR	7/20/77	0000-0000H	99 0
72	" LHR-BOM	7/21/77	1055-1835	70 0
73	" BOM-PER	7/21/77	2311-0412	44 0
74	" PER-MEL	7/22/77	0610-0830	26 0
75	" MEL-SYD	7/22/77	1002-1037	8 0
76	" SYD-MEL	7/23/77	0305-0340	3
77	" MEL-SIN	7/23/77	0530-1228	95 0
78	" SIN-BKK	7/23/77	1418-1543	16 0
79	" BKK-ATH	7/23/77	1732-0202	98 0
80	" ATH-FCO	7/24/77	0448-0553	13 0
81	" FCO-ATH	7/24/77	1927-2027	11 0
82	" ATH-BKK	7/24/77	2228-0703	100 0
83	" BKK-PER	7/25/77	0853-1423	63 0
84	" PER-MEL	7/25/77	1627-1902	32 0
85	" MEL-SYD	7/25/77	2044-2109	5 0
86	GP257 SYD-HKG	7/26/77	0220-1043	124 0 C
87	" HKG-MNL	7/26/77	1257-1352	11
88	" MNL-SYD	7/26/77	1549-2202	105 0 C
89	" SYD-MEL	7/27/77	0403-0440	9 0
90	" MEL-PER	7/27/77	0620-0925	36 0 C

TABLE II - D) VL0011 FILE 4 CONTINUED....

		FLIGHT ROUTE	DEPARTURE DATE	DATA TIME INTVL (GMT)	DATA *
91	GP257	PER-BOM	7/27/77	1223-2008	92 O C
92	"	BOM-LHR	7/27/77	2206-0636	95 O C
93	"	LHR-BOM	7/28/77	1116-1836	85 O C
94	"	BOM-PER	7/28/77	2037-0358	139 O C
95	"	PER-MEL	7/29/77	0551-0821	27 O C
96	"	MEL-SYD	7/29/77	1001-1031	7 O
97	"	SYD-MEL	7/30/77	0318-0353	8 O
98	"	MEL-SIN	7/30/77	0535-1220	79 O C
99	"	SIN-BKK	7/30/77	1450-1604	29 O
100	GP260	SYD-MEL	8/ 2/77	2224-2259	7
101	"	MEL-SYD	8/ 3/77	0326-0356	7
102	"	SYD-SIN	8/ 3/77	0558-1254	82
103	"	SIN-KUL	8/ 3/77	1532-1537	2
104	"	KUL-BAH	8/ 3/77	1719-2329	68
105	"	BAH-AMS	8/ 4/77	0145-0700	60
106	"	AMS-LHR	8/ 4/77	0917-0925	7
107	"	LHR-AMS	8/ 4/77	1826-1831	2
108	"	AMS-BAH	8/ 4/77	2024-0119	56
109	"	BAH-KUL	8/ 5/77	0319-0945	84
110	"	KUL-SIN	8/ 5/77	1130-1130	1
111	"	SIN-SYD	8/ 5/77	1427-2042	74
112	"	SYD-MEL	8/ 5/77	2252-2324	18
113	"	MEL-SYD	8/ 6/77	0320-0350	7
114	"	SYD-SIN	8/ 6/77	0603-1248	78
115	"	SIN-BAH	8/ 6/77	1459-2114	73
116	"	BAH-LHR	8/ 6/77	2321-0501	69
117	"	LHR-BAH	8/ 7/77	2159-0315	57
118	"	BAH-SIN	8/ 8/77	0512-1202	77
119	"	SIN-SYD	8/ 8/77	1424-2054	74
120	"	SYD-MEL	8/ 8/77	2301-2341	9
121	"	MEL-SYD	8/ 9/77	0328-0348	4
122	"	SYD-MEL	8/ 9/77	0431-0506	8
123	"	MEL-PER	8/ 9/77	0641-0948	46
124	"	PER-BOM	8/ 9/77	1142-1922	88
125	"	BOM-LHR	8/ 9/77	2116-0531	95
126	"	LHR-BOM	8/10/77	1046-1826	71
127	"	BOM-PER	8/10/77	2045-0418	87
128	"	PER-MEL	8/11/77	0641-0855	27
129	"	MEL-SYD	8/11/77	1023-1058	7
130	"	SYD-HKG	8/12/77	0245-1034	90
131	"	HKG-SYD	8/12/77	1307-2042	89

* Number of DATA records in flight

O - OZONE

C - CARBON MONOXIDE

TABLE II - FLIGHTS ON GASP TAPE VL0011

E) FILE 5 (QANTAS VH-EBE)

	FLIGHT	ROUTE	DEPARTURE DATE	DATA TIME	DATA * INTVL (GMT)
1	GP266	SYD-MEL	8/15/77	0416-0451	8
2	"	MEL-PER	8/15/77	0623-0928	36
3	"	PER-BKK	8/15/77	1118-1642	73
4	"	BKK-ATH	8/15/77	1924-0414	103
5	"	ATH-FCO	8/16/77	0701-0803	23
6	"	FCO-ATH	8/16/77	1916-2012	22
7	"	ATH-BKK	8/16/77	2222-0637	92
8	"	BKK-SIN	8/17/77	0821-0935	22
9	"	SIN-MEL	8/17/77	1210-1815	73
10	"	MEL-SYD	8/17/77	1958-2028	7
11	"	SYD-SIN	8/18/77	0619-1249	72
12	"	SIN-BAH	8/18/77	1453-2103	16
13	"	BAH-LHR	8/18/77	2345-0518	108
14	"	LHR-BAH	8/20/77	0352-0857	58
15	"	BAH-SIN	8/20/77	1106-1736	71
16	"	SIN-SYD	8/20/77	1952-0154	83
17	"	SYD-AKL	8/22/77	0056-0246	19
18	"	AKL-SYD	8/22/77	0515-0735	28
19	"	SYD-MEL	8/23/77	0306-0341	7
20	"	MEL-SIN	8/23/77	0534-1219	76 O C
21	"	SIN-BAH	8/23/77	1724-2339	71 O C
22	"	BAH-BEG	8/24/77	0517-0901	68 O C
23	"	BEG-VIE	8/24/77	1022-1047	6 O
24	"	VIE-FRA	8/24/77	1218-1243	6 O
25	"	FRA-VIE	8/24/77	1709-1734	6 O
26	"	VIE-BEG	8/24/77	1915-1942	27
27	"	BEG-BAH	8/24/77	2212-0138	38 O C
28	"	BAH-SIN	8/25/77	0411-1059	86 O C
29	"	SIN-MEL	8/25/77	1255-1845	68 O C
30	"	MEL-SYD	8/25/77	2044-2114	7 O
31	"	SYD-MEL	8/26/77	0349-0419	7 O
32	"	MEL-SIN	8/26/77	0609-1309	80 O C
33	"	SIN-BKK	8/26/77	1454-1614	14 O
34	"	BKK-ATH	8/26/77	1809-0243	107 O C
35	"	ATH-BEG	8/27/77	0446-0526	7 O
36	"	BEG-FRA	8/27/77	0706-0806	12 O
37	"	FRA-BEG	8/27/77	1703-1757	25
38	"	BEG-ATH	8/27/77	1950-2020	7 O
39	"	ATH-BAH	8/27/77	2233-0118	25 O C
40	"	BAH-BKK	8/28/77	0329-0909	30 O C
41	"	SIN-MEL	8/28/77	1453-2003	57 O C
42	"	MEL-SYD	8/28/77	2146-2211	6 O
43	GP270	SYD-DRW	8/30/77	1310-1655	46 O C
44	"	DRW-SIN	8/30/77	1852-2207	37 O C
45	"	SIN-BAH	8/31/77	0014-0639	106 O C

TABLE II - E) VL0011 FILE 5 CONTINUED....

		FLIGHT ROUTE	DEPARTURE DATE	DATA TIME INTVL(GMT)	DATA *
46	GP270	BAH-LHR	8/31/77	0831-1411	67 O C
47	"	LHR-BAH	8/31/77	2119-0234	62 O C
48	"	BAH-SIN	9/ 1/77	1131-1801	75 O C
49	"	SIN-SYD	9/ 1/77	2004-0201	88 O C
50	"	SYD-MEL	9/ 2/77	0450-0530	8 O
51	"	MEL-PER	9/ 2/77	0657-0950	35 O C
52	"	PER-BOM	9/ 2/77	1224-1947	87 O C
53	"	BOM-LHR	9/ 2/77	2152-0619	73 O C
54	"	LHR-BOM	9/ 3/77	1112-1852	105 O C
55	"	BOM-PER	9/ 3/77	2107-0449	106 O C
56	"	PER-MEL	9/ 4/77	0711-0941	28 O C
57	"	MEL-SYD	9/ 4/77	1113-1143	7 O
58	"	SYD-NAN	9/ 8/77	0933-1213	33 O C
59	"	NAN-HNL	9/ 8/77	1410-1925	64 O C
60	"	HNL-SFO	9/ 8/77	2138-0118	44 O C
61	GP278	SFO-HNL	9/ 9/77	0428-0850	49 O
62	"	HNL-NAN	9/ 9/77	1118-1628	60 O
63	"	NAN-SYD	9/ 9/77	1813-2153	42 O
64	"	SYD-NAN	9/10/77	0928-1207	32 O
65	"	NAN-HNL	9/10/77	1411-1934	74 O
66	"	HNL-SFO	9/10/77	2209-0154	42 O
67	"	SFO-HNL	9/11/77	0429-0846	50 O
68	"	HNL-NAN	9/11/77	1049-1549	55
69	"	NAN-SYD	9/11/77	1809-2149	37
70	"	SYD-NAN	9/12/77	0930-1219	32
71	"	NAN-HNL	9/12/77	1405-1930	47
72	"	HNL-SFO	9/12/77	2144-0129	25
73	"	SFO-HNL	9/13/77	0650-0845	23
74	"	HNL-NAN	9/13/77	1050-1606	61
75	"	NAN-SYD	9/13/77	1823-2205	53
76	"	SYD-AKL	9/14/77	0125-0307	33
77	"	AKL-SYD	9/14/77	0505-0730	29
78	"	SYD-HNL	9/14/77	1114-1927	109
79	"	HNL-SFO	9/14/77	2150-0130	43
80	"	SFO-HNL	9/15/77	0431-0851	50
81	"	HNL-SYD	9/15/77	1053-1940	113
82	"	SYD-HNL	9/16/77	1111-1936	95
83	"	HNL-SFO	9/16/77	2207-0145	43
84	"	SFO-HNL	9/17/77	0437-0832	48
85	"	HNL-SYD	9/17/77	1103-2003	101
86	"	SYD-HNL	9/18/77	0000-0000M	102
87	"	HNL-SFO	9/18/77	0000-0000M	42
88	"	SFO-YVR	9/18/77	0000-0000M	20
89	"	YVR-SFO	9/19/77	0000-0000M	14
90	"	SFO-HNL	9/19/77	0000-0000M	54

TABLE II - E) VL0011 FILE 5 CONTINUED....

		FLIGHT ROUTE	DEPARTURE DATE	DATA TIME INTVL (GMT)	DATA *
91	GP278	HNL-SYD	9/19/77	0000-0000M	86
92	"	SYD-HKG	9/20/77	0000-0000M	71
93	"	MNL-SYD	9/20/77	1637-2225	47
94	"	SYD-HNL	9/21/77	1111-1935	93
95	"	HNL-SFO	9/21/77	2151-0159	57
96	"	SFO-HNL	9/22/77	0437-0827	46
97	"	HNL-SYD	9/22/77	1042-1937	101
98	GP287	SYD-HNL	9/23/77	1100-1943	92
99	"	HNL-SFO	9/23/77	2203-0203	35
100	"	SFO-HNL	9/24/77	0431-0831	35 O
101	"	HNL-SYD	9/24/77	1055-1935	71 O C
102	"	SYD-HNL	9/25/77	0542-1337	61 O C
103	"	HNL-SFO	9/25/77	1619-1957	26 O
104	"	SFO-YVR	9/25/77	2154-2259	10 O
105	"	YVR-SFO	9/26/77	0142-0242	8 O
106	"	SFO-HNL	9/26/77	0458-0908	37 O C
107	"	HNL-SYD	9/26/77	1215-2044	80 O C
108	"	SYD-HKG	9/27/77	0232-1012	81 O
109	"	HKG-MNL	9/27/77	1303-1405	19 O
110	"	MNL-SYD	9/27/77	1616-2253	85 O C
111	"	SYD-NAN	9/29/77	0935-1225	30 O
112	"	NAN-HNL	9/29/77	1409-1924	61 O C
113	"	HNL-SFO	9/29/77	2147-0122	37 O
114	"	SFO-HNL	9/30/77	0427-0847	50 O C
115	"	HNL-NAN	9/30/77	1057-1612	61 O C
116	"	NAN-SYD	9/30/77	1821-2145	38 O C
117	"	SYD-MEL	10/ 1/77	0011-0051	9 O
118	"	MEL-SYD	10/ 1/77	0324-0349	6 O
119	"	SYD-NAN	10/ 1/77	0933-1224	58 O C
120	"	NAN-HNL	10/ 1/77	1409-1929	68 O C
121	"	HNL-SFO	10/ 1/77	2144-0134	30 O C
122	"	SFO-HNL	10/ 2/77	0425-0841	33 O C
123	"	HNL-NAN	10/ 2/77	1051-1611	36
124	"	NAN-SYD	10/ 2/77	1820-2215	30

* Number of DATA records in flight

O - OZONE

C - CARBON MONOXIDE

TABLE III - FLIGHTS ON GASP TAPE VL0013

A) FILE 1 (PANAM -N655PA)

	FLIGHT	ROUTE	DEPARTURE DATE	DATA TIME INTVL (GMT)	DATA *
1	GP192	SFO-HND	2/22/77	2117-0711	92
2	"	HND-HKG	2/23/77	1005-1337	34
3	"	HKG-BKK	2/23/77	1610-1908	29
4	"	BKK-KHI	2/23/77	2112-0124	32
5	"	KHI-THR	2/24/77	0300-0512	18
6	"	THR-FRA	2/24/77	0748-1228	40
7	"	FRA-LHR	2/24/77	1416-1450	8
8	"	LHR-JFK	2/24/77	1841-0049	42
9	"	JFK-LHR	2/25/77	1538-2116	74
10	"	LHR-BRU	2/25/77	2257-2259	2
11	"	BRU-LHR	2/26/77	0903-0912	2
12	"	LHR-JFK	2/26/77	1158-1753	55
13	"	JFK-FRA	2/26/77	2340-0522	45
14	"	FRA-MUC	2/27/77	0753-0753	1
15	"	MUC-FRA	2/27/77	1127-1132	2
16	"	FRA-JFK	2/27/77	1332-2022	52
17	"	JFK-LHR	2/28/77	1538-1944	31
18	"	LHR-BRU	2/28/77	2300-2300	1
19	"	BRU-LHR	3/ 1/77	0901-0901	1
20	"	LHR-JFK	3/ 1/77	1136-1812	57
21	"	JFK-FRA	3/ 1/77	2332-0445	45
22	"	FRA-MUC	3/ 2/77	0752-0757	2
23	"	MUC-FRA	3/ 2/77	0100-0100	1
24	"	FRA-JFK	3/ 2/77	1349-2058	87
25	"	JFK-LHR	3/ 4/77	0035-0504	30
26	"	LHR-FRA	3/ 4/77	0925-0935	2
27	"	FRA-THR	3/ 4/77	1156-1543	36
28	GP207	SFO-SEA	3/11/77	1926-2016	7
29	"	SEA-LHR	3/11/77	2237-0544	55
30	"	SFO-HNL	3/18/77	0433-0825	48
31	"	HNL-GUM	3/18/77	1116-1801	80
32	"	GUM-MNL	3/18/77	2021-2251	30
33	"	MNL-HKG	3/19/77	0029-0139	15
34	"	HKG-MNL	3/19/77	0623-0723	13
35	"	MNL-GUM	3/19/77	0929-1158	31
36	"	GUM-HNL	3/19/77	1437-2017	67
37	"	HNL-HND	3/19/77	2312-0647	90
38	"	HND-HNL	3/20/77	1230-1820	70
39	"	HNL-SEA	3/20/77	2229-0304	55
40	"	SFO-HND	3/23/77	2104-0743	287
41	"	HND-HKG	3/24/77	0959-1406	65
42	"	HKG-BKK	3/24/77	1529-1829	36
43	"	BKK-DEL	3/24/77	2024-2325	52
44	"	DEL-THR	3/25/77	0151-0451	36
45	"	THR-FRA	3/25/77	0644-1102	64

TABLE III - A) VL0013 FILE 1 CONTINUED....

		FLIGHT ROUTE	DEPARTURE DATE	DATA TIME INTVL (GMT)	DATA *
46	GP207	FRA-LHR	3/25/77	1335-1410	8
47	"	LHR-JFK	3/25/77	1735-2325	67
48	"	JFK-LHR	3/26/77	1520-2055	66
49	"	LHR-AMS	3/26/77	2229-2234	2
50	"	AMS-LHR	3/27/77	0809-0824	4
51	"	LHR-JFK	3/27/77	1045-1629	66
52	"	JFK-LHR	3/28/77	0047-0622	67
53	"	LHR-FRA	3/28/77	0917-0942	6
54	"	FRA-THR	3/28/77	1150-1545	47
55	"	THR-DEL	3/28/77	1818-2058	33
56	"	DEL-BKK	3/28/77	2253-0143	48
57	"	BKK-HKG	3/29/77	0357-0642	34
58	"	HKG-HND	3/30/77	0315-0552	48
59	"	HND-SFO	3/30/77	0807-1624	112
60	"	SFO-HND	3/30/77	2106-0708	145
61	"	HND-HKG	3/31/77	0944-1339	45
62	"	HKG-BKK	3/31/77	1531-1826	34
63	"	BKK-DEL	3/31/77	2019-2328	37
64	"	DEL-THR	4/ 1/77	0211-0512	51
65	"	THR-FRA	4/ 1/77	0718-1135	207
66	"	FRA-LHR	4/ 1/77	1347-1422	8
67	"	LHR-JFK	4/ 1/77	1735-2355	74
68	"	JFK-FCO	4/ 2/77	0309-0952	78
69	"	FCO-JFK	4/ 2/77	1244-2038	178
70	"	JFK-LHR	4/ 3/77	1554-2127	107
71	"	LHR-BRU	4/ 3/77	2238-2248	3
72	"	BRU-LHR	4/ 4/77	0753-0803	3
73	"	LHR-JFK	4/ 4/77	1025-1636	74
74	"	JFK-LHR	4/ 5/77	0101-0648	68
75	"	LHR-FRA	4/ 5/77	0912-0942	6
76	"	FRA-THR	4/ 5/77	1150-1540	44
77	"	THR-DEL	4/ 5/77	1816-2041	30
78	"	DEL-BKK	4/ 5/77	2254-0144	33
79	GP215	SFO-HND	4/ 7/77	2109-0635	123
80	"	HND-HKG	4/ 8/77	1004-1329	42
81	"	HKG-BKK	4/ 8/77	1519-1814	35
82	"	BKK-DEL	4/ 8/77	2016-2341	41
83	"	DEL-THR	4/ 9/77	0207-0517	38
84	"	THR-FRA	4/ 9/77	0713-0906	24

* Number of DATA records in flight

TABLE III - FLIGHTS ON GASP TAPE VL0013

B) FILE 2 (PANAM -N655PA)

	FLIGHT	DEPARTURE	DATA TIME	DATA
	ROUTE	DATE	INTVL (GMT)	*
1	GP218 SFO-HNL	4/15/77	0430-0835	47 C
2	" HNL-GUM	4/15/77	1101-1811	81 C
3	" GUM-MNL	4/15/77	2023-2258	32 C
4	" MNL-HKG	4/16/77	0035-0140	14 C
5	" HKG-MNL	4/16/77	0624-0724	13
6	" MNL-GUM	4/17/77	0456-0721	29
7	" GUM-HNL	4/17/77	0947-1512	80 C
8	" HNL-SFO	4/17/77	1848-2243	47 C
9	" SFO-HND	4/18/77	2132-0732	118 C
10	" HND-HKG	4/19/77	1002-1342	45 C
11	" HKG-BKK	4/19/77	1525-1817	34 C
12	" BKK-DEL	4/19/77	2020-2326	58 C
13	" DEL-THR	4/20/77	0133-0438	36 C
14	" THR-FRA	4/20/77	0650-1139	105 C
15	" FRA-LHR	4/20/77	1343-1418	54
16	" LHR-JFK	4/20/77	1730-1856	33 C
17	GP230 LAX-HNL	5/ 5/77	0323-0803	56 O C
18	" HNL-NAN	5/ 5/77	1028-1553	66 O C
19	" NAN-SYD	5/ 5/77	1749-2135	98 O C
20	" SYD-MEL	5/ 6/77	0004-0034	7 O
21	" MEL-SYD	5/ 6/77	0310-0340	7 O
22	" SYD-NAN	5/ 6/77	0649-0940	33 O C
23	" NAN-HNL	5/ 6/77	1133-1638	60 O C
24	" HNL-LAX	5/ 6/77	1945-2340	44 O C
25	" LAX-HNL	5/ 7/77	0334-0821	72 O C
26	" LAX-HNL	5/ 9/77	0325-0800	54 O
27	" HNL-AKL	5/ 9/77	1033-1838	96 O
28	" AKL-HNL	5/10/77	0946-1639	97 O
29	" HNL-SEA	5/10/77	2137-0202	51
30	" SEA-FAI	5/11/77	0500-0720	29 O
31	" FAI-SEA	5/11/77	1034-1304	30 O
32	" SEA-HNL	5/11/77	1639-2219	111 O
33	" HNL-LAX	5/12/77	0015-0415	122 O
34	" LAX-SFO	5/12/77	0649-0709	5 O
35	" SFO-LAX	5/12/77	1451-1619	22 O
36	" LAX-GUA	5/12/77	1645-2235	46 O
37	" GUA-PTY	5/12/77	2220-0035	15
38	" PTY-GIG	5/13/77	0053-0824	86 O
39	" GIG-JFK	5/14/77	0227-1050	113 O
40	" JFK-FRA	5/14/77	2246-0450	70 O
41	" FRA-MUC	5/15/77	0645-0650	2
42	" MUC-FRA	5/15/77	1036-1046	3
43	" FRA-JFK	5/15/77	1258-2000	83
44	" JFK-LHR	5/15/77	2330-0457	66
45	" LHR-AMS	5/16/77	0802-0807	2

TABLE III - B) VL0013 FILE 2 CONTINUED....

	FLIGHT	DEPARTURE	DATA TIME	DATA
	ROUTE	DATE	INTVL (GMT)	*
46	GP230	AMS-LHR	5/16/77	1007-1019 4
47	"	LHR-JFK	5/16/77	1211-1833 76
48	"	JFK-FCO	5/17/77	0048-0753 84
49	"	FCO-JFK	5/17/77	1131-1941 93
50	GP237	JFK-LHR	5/19/77	0208-0743 64 0
51	"	LHR-FRA	5/19/77	1352-1421 16
52	"	FRA-THR	5/19/77	1634-2055 86 0
53	"	THR-DEL	5/20/77	2104-2341 43 0
54	"	DEL-THR	5/21/77	0216-0514 46 0
55	"	THR-FRA	5/21/77	0709-1133 62 0
56	"	FRA-LHR	5/21/77	1340-1415 8 0
57	"	LHR-JFK	5/21/77	1605-2208 71 0
58	"	JFK-LHR	5/22/77	1434-2024 70 0
59	"	LHR-BRU	5/22/77	2226-2231 2
60	"	BRU-LHR	5/23/77	0752-0802 3 0
61	"	LHR-IAD	5/23/77	1202-1827 75 0
62	"	JFK-SNN	5/24/77	0122-0637 62 0
63	"	SNN-FRA	5/24/77	0754-0909 15
64	"	FRA-JFK	5/24/77	1134-1824 81 0
65	"	IAD-LHR	5/25/77	0107-0722 72 0
66	"	LHR-IAD	5/25/77	1202-1822 74 0
67	"	JFK-FRA	5/26/77	0124-0749 77 0
68	"	FRA-JFK	5/26/77	1044-1724 79 0
69	"	IAD-LHR	5/27/77	0112-0714 71 0
70	"	LHR-JFK	5/27/77	1034-1615 66 0
71	"	JFK-FRA	5/27/77	2247-0509 84 0
72	"	FRA-MUC	5/28/77	0649-0654 2
73	"	MUC-FRA	5/28/77	1046-1051 2
74	"	FRA-JFK	5/28/77	1306-1953 90 0
75	"	JFK-GIG	5/29/77	0134-0930 92 0
76	"	GIG-VCP	5/29/77	1115-1135 5 0
77	"	VCP-GIG	5/30/77	0156-0211 4 0
78	"	GIG-CCS	5/30/77	0416-0919 60 0
79	"	CCS-GUA	5/30/77	1143-1413 29 0
80	"	GUA-LAX	5/30/77	1711-2101 45 0
81	"	LAX-SFO	5/30/77	2311-2334 6 0
82	"	SFO-HNL	5/31/77	0327-0732 47 0
83	"	HNL-GUM	5/31/77	1001-1626 75 0
84	"	GUM-OKA	5/31/77	1919-2144 28 0
85	"	OKA-TPE	5/31/77	2318-2348 7 0
86	"	TPE-HKG	6/ 1/77	0120-0204 10 0
87	"	HKG-TPE	6/ 1/77	0453-0533 9 0
88	"	TPE-OKA	6/ 1/77	0732-0757 6 0
89	"	OKA-GUM	6/ 1/77	0930-1140 27 0
90	"	GUM-HNL	6/ 1/77	1433-2043 66 0

TABLE III - B) VL0013 FILE 2 CONTINUED....

	FLIGHT	DEPARTURE	DATA TIME	DATA
	ROUTE	DATE	INTVL (GMT)	*
91	GP237 HNL-HND	6/ 1/77	2314-0613	78 0
92	" HND-HNL	6/ 2/77	1241-1856	74 0
93	" HNL-SEA	6/ 2/77	2137-0146	50 0
94	" SEA-FAI	6/ 3/77	0454-0717	29 0
95	" FAI-SEA	6/ 3/77	1023-1258	32 0
96	" SEA-HNL	6/ 3/77	1649-2154	57 0
97	" HNL-LAX	6/ 4/77	0022-0637	48
98	" LAX-HNL	6/ 4/77	1609-2034	50 0
99	" HNL-HND	6/ 4/77	2313-0608	80 0
100	" HND-HNL	6/ 5/77	1233-1834	71 0
101	" HNL-SEA	6/ 5/77	2135-0140	45 0
102	" SEA-FAI	6/ 6/77	0503-0723	27 0
103	" FAI-SEA	6/ 6/77	1021-1300	32 0
104	" SEA-HNL	6/ 6/77	1647-2137	51 0
105	" HNL-LAX	6/ 7/77	0011-0416	49 0
106	" LAX-SFO	6/ 7/77	0640-0700	5 0
107	" SFO-LAX	6/ 7/77	1451-1516	6 0
108	" LAX-GUA	6/ 7/77	1721-2101	46 0
109	" GUA-LAX	6/ 9/77	1654-2040	77 0
110	" LAX-HNL	6/10/77	0331-0758	57 0
111	" HNL-PPG	6/10/77	1049-1514	49 0
112	" PPG-SYD	6/10/77	1702-2212	61
113	" SYD-MEL	6/11/77	0017-0057	9 0
114	" MEL-SYD	6/11/77	0400-0435	8 0
115	" SYD-PPG	6/11/77	0635-1043	67 0
116	" PPG-HNL	6/11/77	1245-1648	45 0
117	" HNL-LAX	6/11/77	1943-2348	48 0
118	" LAX-HNL	6/12/77	0346-0824	65 0
119	" HNL-PPG	6/12/77	1106-1523	64 0
120	" PPG-SYD	6/12/77	1723-2238	61 0
121	" SYD-MEL	6/13/77	0038-0113	8 0
122	" MEL-SYD	6/13/77	0401-0426	5
123	" SYD-PPG	6/13/77	0624-1039	50 0
124	" PPG-HNL	6/13/77	1223-1649	63 0
125	" HNL-LAX	6/13/77	1948-2348	45 0
126	" LAX-SFO	6/14/77	0155-0220	6 0

* Number of DATA records in flight

O - OZONE

C - CARBON MONOXIDE

TABLE III - FLIGHTS ON GASP TAPE VL0013

C) FILE 3 (PANAM -N655PA)

	FLIGHT	ROUTE	DEPARTURE	DATA TIME	DATA	*
			DATE	INTVL (GMT)		
1	GP241	SFO-LAX	6/14/77	1447-1512	6	
2	"	LAX-GUA	6/14/77	1732-2109	103	
3	"	GUA-LAX	6/17/77	1110-1450	55	
4	"	LAX-SFO	6/17/77	1716-1736	5	
5	"	SFO-HNL	6/17/77	2230-0234	49	
6	"	HNL-GUM	6/18/77	0638-1253	74	
7	"	GUM-MNL	6/18/77	1509-1739	31	
8	"	MNL-HKG	6/18/77	1924-2030	39	
9	"	HKG-MNL	6/19/77	0011-0114	48	
10	"	MNL-GUM	6/19/77	0323-0552	31	
11	"	GUM-HNL	6/19/77	0824-1427	73	
12	"	HNL-HND	6/19/77	1737-0019	93	
13	"	HND-HNL	6/20/77	0651-1253	84	
14	"	HNL-SEA	6/20/77	1548-2013	50	
15	"	SEA-FAI	6/20/77	2321-0141	29	
16	"	FAI-SEA	6/21/77	0439-0709	30	
17	"	SEA-HNL	6/21/77	1105-1545	56	
18	"	HNL-LAX	6/21/77	1845-2257	48	
19	"	LAX-SFO	6/22/77	0102-0127	5	
20	"	SFO-HND	6/22/77	1626-0157	112	
21	"	HND-HKG	6/23/77	0430-0745	40	
22	"	HKG-BKK	6/23/77	0945-1235	35	
23	"	BKK-KHI	6/23/77	1438-1816	54	
24	"	KHI-THR	6/23/77	2023-2221	25	
25	"	THR-FRA	6/24/77	0119-0542	52	
26	"	FRA-LHR	6/24/77	0747-0817	7	
27	"	LHR-JFK	6/24/77	1024-1639	73	
28	GP246	JFK-LHR	6/25/77	0126-0641	64	0
29	"	LHR-FRA	6/25/77	0915-0940	6	0
30	"	FRA-THR	6/25/77	1147-1532	41	0
31	"	THR-KHI	6/25/77	1806-1951	22	0
32	"	KHI-BKK	6/25/77	2147-0147	105	0
33	"	BKK-HKG	6/26/77	0346-0646	36	
34	"	HKG-HND	6/27/77	0118-0420	51	
35	"	HND-SFO	6/27/77	0644-1504	95	
36	"	SFO-LAX	6/28/77	0004-0035	33	
37	"	LAX-HNL	6/28/77	0332-0747	50	
38	"	HNL-LAX	6/28/77	2037-2347	35	
39	"	LAX-HNL	6/29/77	0341-0803	50	
40	"	HNL-PPG	6/29/77	1056-1511	51	
41	"	PPG-SYD	6/29/77	1658-2206	99	
42	"	SYD-MEL	6/30/77	0040-0115	8	
43	"	MEL-SYD	6/30/77	0402-0432	7	
44	"	SYD-PPG	6/30/77	0627-1042	50	
45	"	PPG-HNL	6/30/77	1226-1641	50	

TABLE III - C) VL0013 FILE 3 CONTINUED....

	FLIGHT ROUTE	DEPARTURE DATE	DATA TIME INTVL (GMT)	DATA *
46	GP246 HNL-LAX	6/30/77	1958-2358	49
47	" LAX-HNL	7/ 1/77	0334-0809	55
48	" HNL-PPG	7/ 1/77	1058-1511	50
49	" PPG-SYD	7/ 1/77	1707-2204	56
50	" SYD-MEL	7/ 2/77	0008-0043	6
51	" MEL-SYD	7/ 2/77	0406-0431	6
52	" SYD-PPG	7/ 2/77	0633-1038	47
53	" PPG-HNL	7/ 2/77	1235-1650	49
54	" HNL-LAX	7/ 2/77	1953-0003	50
55	" LAX-HNL	7/ 3/77	0327-0742	51
56	" HNL-PPG	7/ 3/77	1046-1456	75
57	" PPG-SYD	7/ 3/77	1656-2211	63
58	" SYD-MEL	7/ 4/77	0017-0052	8
59	" MEL-SYD	7/ 4/77	0411-0441	7
60	" SYD-PPG	7/ 4/77	0629-1034	48
61	" PPG-HNL	7/ 4/77	1227-1657	53
62	" HNL-LAX	7/ 4/77	1949-2359	48
63	" LAX-SFO	7/ 5/77	0244-0307	7
64	" SFO-LAX	7/ 5/77	1312-1337	6
65	" LAX-HNL	7/ 5/77	1624-2048	51
66	" HNL-HND	7/ 5/77	2344-0629	80
67	" HND-HNL	7/ 6/77	1226-1836	71
68	" HNL-SEA	7/ 6/77	2139-0209	55
69	" SEA-FAI	7/ 7/77	0458-0728	28
70	" FAI-SEA	7/ 7/77	1036-1305	31
71	" SEA-HNL	7/ 7/77	1640-2125	57
72	" HNL-LAX	7/ 8/77	0027-0430	48
73	" LAX-SFO	7/ 8/77	0631-0656	6

* Number of DATA records in flight

O - OZONE

TABLE III - FLIGHTS ON GASP TAPE VL0013

D) FILE 4 (PANAM -N655PA)

	FLIGHT ROUTE	DEPARTURE DATE	DATA TIME INTVL (GMT)	DATA *
1	GP254 SFO-LAX	7/ 8/77	1457-1518	5 F
2	" LAX-GUA	7/ 8/77	1738-2113	44
3	" GUA-CCS	7/ 8/77	2318-0159	48
4	" CCS-GUA	7/ 9/77	1202-1436	32
5	" GUA-LAX	7/ 9/77	1733-2118	45
6	" LAX-SFO	7/10/77	0001-0021	5
7	" SFO-HNL	7/10/77	0344-0754	49
8	" HNL-GUM	7/10/77	1011-1626	73
9	" GUM-MNL	7/10/77	1857-2117	28
10	" MNL-HKG	7/10/77	2313-0008	11
11	" HKG-MNL	7/11/77	0615-0724	38 F
12	" MNL-GUM	7/11/77	0908-1153	34
13	" GUM-HNL	7/11/77	1355-2000	73
14	" HNL-SFO	7/11/77	2334-0324	46
15	" SFO-LAX	7/12/77	1454-1519	6
16	" LAX-GUA	7/12/77	1725-2103	56
17	" GUA-LAX	7/14/77	1649-2024	42
18	" LAX-SFO	7/14/77	1701-1721	5
19	" SFO-HNL	7/15/77	0338-0748	49
20	" HNL-GUM	7/15/77	1155-1830	78
21	" GUM-MNL	7/15/77	2034-2304	30
22	" MNL-HKG	7/15/77	2350-0054	39
23	" HKG-MNL	7/16/77	0057-0158	12 F
24	" MNL-GUM	7/16/77	0403-0634	55
25	" GUM-HNL	7/16/77	0859-1501	93
26	" HNL-HND	7/16/77	0000-0000M	93
27	" HND-HNL	7/17/77	0735-1344	94
28	" HNL-SEA	7/17/77	1624-2051	64
29	" SEA-FAI	7/17/77	2355-0225	28
30	" FAI-SEA	7/18/77	0531-0756	30
31	" SEA-HNL	7/18/77	1138-1618	55
32	" HNL-LAX	7/18/77	1940-2339	41
33	" LAX-SFO	7/19/77	0147-0152	2 F
34	" SFO-LAX	7/19/77	0815-0831	17
35	" LAX-HNL	7/19/77	1117-1551	69
36	" HNL-LAX	7/20/77	1455-1850	47
37	" LAX-HNL	7/20/77	2228-0308	56
38	" HNL-NAN	7/21/77	0531-1043	74
39	" NAN-SYD	7/21/77	1148-1643	46
40	" SYD-MEL	7/21/77	1848-1923	8
41	" MEL-SYD	7/21/77	0203-0232	7
42	" SYD-NAN	7/22/77	0138-0418	32 F
43	" NAN-HNL	7/22/77	0630-1148	77
44	" HNL-LAX	7/22/77	1452-1902	47
45	" LAX-HNL	7/22/77	2236-0251	47

TABLE III - D) VI.0013 FILE 4 CONTINUED....

		FLIGHT ROUTE	DEPARTURE DATE	DATA TIME INTVL (GMT)	DATA *
46	GP254	HNL-NAN	7/23/77	0550-1057	61
47	"	NAN-SYD	7/23/77	1256-1646	43
48	"	SYD-MEL	7/23/77	1919-1954	8
49	"	MEL-SYD	7/23/77	2158-2231	8
50	"	SYD-NAN	7/24/77	0130-0415	34
51	"	NAN-HNL	7/24/77	0747-1309	73
52	"	HNL-LAX	7/24/77	1526-1929	45
53	"	LAX-HNL	7/24/77	2232-0307	52
54	"	HNL-AKL	7/25/77	0545-1318	95 F
55	"	AKL-SYD	7/25/77	1539-1809	31
56	"	SYD-AKL	7/26/77	0028-0213	19
57	"	AKL-HNL	7/26/77	0438-1148	94
58	"	HNL-SFO	7/26/77	1846-2238	45
59	GP259	SFO-HND	7/27/77	2219-0747	128
60	"	HND-HKG	7/28/77	1018-1313	35
61	"	HKG-BKK	7/28/77	1517-1800	107
62	"	BKK-DEL	7/28/77	2019-2319	72
63	"	DEL-THR	7/29/77	0254-0534	33
64	"	THR-FRA	7/29/77	1234-1712	71 F
65	"	FRA-LHR	7/29/77	1931-2001	29
66	"	LHR-JFK	7/29/77	2233-0438	68
67	GP267	SFO-LAX	8/12/77	1451-1516	6
68	"	LAX-GUA	8/12/77	1732-2106	42
69	"	GUA-CCS	8/12/77	2352-0234	48 F
70	"	CCS-GUA	8/13/77	1224-1459	30
71	"	GUA-LAX	8/13/77	1741-2316	44
72	"	LAX-SFO	8/13/77	2353-0013	5
73	"	SFO-LAX	8/14/77	0309-0329	5
74	"	LAX-PPT	8/14/77	0514-1200	86
75	"	PPT-AKL	8/14/77	1406-1856	55
76	"	AKL-PPT	8/15/77	0138-0522	75
77	"	PPT-LAX	8/15/77	0724-1416	99
78	"	LAX-SFO	8/15/77	1701-1722	31
79	"	SFO-JFK	8/15/77	2018-0008	44
80	"	LHR-BOS	8/18/77	1333-2004	83
81	"	BOS-LHR	8/19/77	0243-0738	59
82	"	LHR-IAD	8/19/77	1355-2115	87
83	"	IAD-LHR	8/20/77	0114-0633	62
84	"	LHR-SFO	8/20/77	1607-0141	111
85	"	SFO-LAX	8/21/77	0534-0559	6
86	"	LAX-PPT	8/21/77	0843-1538	80
87	"	PPT-AKL	8/21/77	1733-2213	57
88	"	AKL-PPT	8/22/77	0027-0417	46
89	"	PPT-LAX	8/22/77	0616-1310	91
90	"	LAX-SFO	8/22/77	1723-1748	6

TABLE III - D) VL0013 FILE 4 CONTINUED....

	FLIGHT ROUTE	DEPARTURE DATE	DATA TIME INTVL (GMT)	DATA *
91	GP267 SFO-JFK	8/22/77	1845-2235	42
92	" JFK-LHR	8/24/77	0111-0621	50
93	" LHR-FRA	8/24/77	1122-1147	6
94	" FRA-THR	8/24/77	1156-1556	45
95	" THR-KHI	8/24/77	1849-2034	19
96	" KHI-BKK	8/24/77	2214-0221	48
97	" BKK-HKG	8/25/77	0412-0707	35
98	" HKG-MNL	8/25/77	0910-1015	13
99	" MNL-GUM	8/25/77	1210-1450	29
100	" GUM-HNL	8/25/77	1709-2329	73
101	" HNL-LAX	8/26/77	0231-0641	51
102	" LAX-SFO	8/26/77	0905-0930	6
103	" SFO-LAX	8/26/77	1318-1338	4
104	" LAX-HNL	8/26/77	1621-2046	53
105	" HNL-HND	8/26/77	2316-0546	76
106	" HND-HKG	8/27/77	1107-1412	34
107	" HKG-BKK	8/27/77	1558-1843	33
108	" BKK-KHI	8/27/77	2023-0003	44
109	" KHI-THR	8/28/77	0159-0351	23
110	" THR-FRA	8/28/77	0657-1123	53
111	" FRA-LHR	8/28/77	1436-1506	6
112	" LHR-JFK	8/28/77	1717-2337	73
113	" JFK-LHR	8/29/77	1626-2151	65
114	" LHR-BRU	8/29/77	2327-2337	3
115	" BRU-LHR	8/30/77	0806-0816	3
116	" LHR-SFO	8/30/77	1328-2313	108
117	" SFO-LHR	8/31/77	0332-1309	107
118	" LHR-SEA	8/31/77	1604-0049	102
119	" SEA-SFO	9/ 1/77	0326-0421	12

* Number of DATA records in flight

F - FILTER EXPOSURE

TABLE III - FLIGHTS ON GASP TAPE VL0013

E) FILE 5 (PANAM -N655PA)

	FLIGHT	DEPARTURE	DATA TIME	DATA
	ROUTE	DATE	INTVL (GMT)	*
1	GP273 SFO-LHR	9/ 2/77	0158-1048	105
2	" LHR-SEA	9/ 2/77	1410-2230	95
3	" SEA-LHR	9/ 3/77	0134-0953	91 F
4	" LHR-IAD	9/ 3/77	1417-2132	83
5	" JFK-LHR	9/ 4/77	2338-0443	60
6	" LHR-AMS	9/ 5/77	0717-0722	2
7	" AMS-LHR	9/ 5/77	1000-1000	1
8	" LHR-JFK	9/ 5/77	1529-2220	79
9	" JFK-FCO	9/ 6/77	0214-0849	76 F
10	" FCO-JFK	9/ 6/77	1319-2219	105
11	" JFK-FCO	9/ 7/77	0146-0816	74
12	" FCO-JFK	9/ 7/77	1228-2128	107
13	" JFK-FCO	9/ 8/77	0047-0717	78
14	" FCO-JFK	9/ 8/77	1219-2042	99
15	GP280 JFK-LHR	9/ 9/77	1538-2053	60
16	" LHR-BRU	9/ 9/77	2243-2248	2
17	" LHR-FRA	9/10/77	1549-1609	5
18	" FRA-THR	9/10/77	1805-2150	45
19	" THR-KHI	9/11/77	0007-0147	18 F
20	" KHI-BKK	9/11/77	0336-0727	44
21	" BKK-HKG	9/11/77	0909-1159	34
22	" HKG-HND	9/12/77	0139-0444	37
23	" HND-SFO	9/12/77	0700-1520	93
24	" SFO-JFK	9/12/77	1828-2218	44
25	" JFK-LHR	9/13/77	1416-1941	64
26	" LHR-BRU	9/13/77	2001-2006	2
27	" BRU-LHR	9/14/77	1120-1120	1
28	" LHR-IAD	9/14/77	1257-1932	76
29	" JFK-FRA	9/15/77	0129-0728	70 F
30	" FRA-JFK	9/15/77	1107-1807	82
31	" PHL-LHR	9/16/77	0213-0748	66
32	" LHR-JFK	9/16/77	1408-2023	73
33	" JFK-LHR	9/17/77	0000-0529	64
34	" LHR-AMS	9/17/77	0715-0725	3
35	" AMS-LHR	9/17/77	1015-1020	2
36	" LHR-JFK	9/17/77	1249-1854	69
37	" JFK-LHR	9/18/77	0038-0613	66
38	" LHR-AMS	9/18/77	0816-0826	3
39	" AMS-LHR	9/18/77	1050-1055	2
40	" LHR-JFK	9/18/77	1358-1958	73
41	" JFK-FRA	9/19/77	2301-0526	71
42	" FRA-JFK	9/20/77	1047-1746	81
43	" JFK-FRA	9/21/77	0122-0747	74
44	" FRA-JFK	9/21/77	1153-1858	81
45	" IAD-LHR	9/22/77	0131-0730	66

TABLE III - E) VL0013 FILE 5 CONTINUED....

	FLIGHT	DEPARTURE	DATA TIME	DATA
	ROUTE	DATE	INTVL (GMT)	*
46	GP280	LHR-BOS	9/22/77	1021-1603
47	"	BOS-DTW	9/22/77	1857-1957
48	"	DTW-BOS	9/22/77	2229-2314
49	"	BOS-LHR	9/23/77	0208-0718
50	"	LHR-JFK	9/23/77	1336-1946
51	GP285	IAD-LHR	9/24/77	0857-1347
52	"	LHR-JFK	9/24/77	1847-0027
53	"	JFK-LHR	9/25/77	1636-2124
54	"	LHR-IAD	9/26/77	1321-1936
55	"	JFK-FRA	9/27/77	0556-1051
56	"	FRA-JFK	9/27/77	1358-2158
57	"	IAD-LHR	9/28/77	0233-0758
58	"	LHR-JFK	9/28/77	1351-2020
59	"	JFK-LHR	9/29/77	0058-0443
60	"	LHR-AMS	9/29/77	0722-0722
61	"	LHR-JFK	9/29/77	1336-2051
62	"	JFK-FCO	9/30/77	0102-0732
63	"	FCO-JFK	9/30/77	1210-1910
64	"	JFK-LHR	9/30/77	2347-0447
65	"	LHR-AMS	10/ 1/77	0712-0717
66	"	LHR-JFK	10/ 1/77	1353-2123
67	"	JFK-LHR	10/ 2/77	0145-0725
68	"	LHR-AMS	10/ 2/77	0939-0944
69	"	AMS-LHR	10/ 2/77	1213-1218
70	"	LHR-JFK	10/ 2/77	1428-2043
71	"	JFK-DEL	10/ 3/77	0159-2037
72	"	DEL-BKK	10/ 3/77	2251-0006
73	"	HKG-HND	10/ 5/77	0310-0430
74	"	HND-SFO	10/ 5/77	0647-1427

* Number of DATA records in flight

F - FILTER EXPOSURE

TABLE IV - FILTER DATA ON TAPE VL0013

Exposure Data

Filter no.	401-1	401-2	401-3	401-4	401-5
File,Flight	4,1	4,11	4,23	4,33	4,42
Route	SFO-LAX	HKG-MNL	HKG-MNL	LAX-SFO	SYD-NAN
Date	7/8/77	7/11/77	7/16/77	7/19/77	7/22/77
Time, GMT	1503-1519	0626-0722	0108-0159	0142-0156	0153-0348
Latitude, deg	37-35N	21-16N	21-16N	35-37N	35-22S
Longitude, deg	121-119W	116-121E	116-121E	120-122W	155-172E
Altitude, km	9.8-9.5	9.8-8.4	9.8-9.5	10.6-9.5	9.7-10.1
Region **	T	T	T	T	T

Constituent Data

SO ₄ =, $\mu\text{g}/\text{m}^3$	.000	.005	.005	.044	.016
NO ₃ =, "	.000	.004	.004	.000	.013
Cl=, "	.000	.000	.000	.000	.003
F=, "	.000	.000	.000	.000	.000

** - T - Troposphere
 S - Stratosphere
 U - Uncertain or mixed

TABLE IV - FILTER DATA ON TAPE VL0013, CONTINUED

Exposure Data

Filter no.	401-6	401-7	401-8	501-5	501-6
File, Flight	4,54	4,64	4,69	5,3	5,9
Route	HNL-AKL	THR-FRA	GUA-CCS	SEA-LHR	JFK-FCO
Date	7/25/77	7/29/77	8/13/77	9/3/77	9/6/77
Time, GMT	0828-1028	1247-1447	0008-0208	0153-0353	0224-0424
Latitude, deg	0-14S	37-40N	14-11N	49-52N	42-49N
Longitude, deg	170-180W	48-31E	88-72W	115-85W	70-46W
Altitude, km	9.7-11.3	9.9-10.7	11.3-11.3	9.7-10.1	9.7-10.7
Region **	T	T	T	T	T

Constituent Data

SO ₄ ⁻ , $\mu\text{g}/\text{m}^3$	.003	.006	.019	.041	.043
NO ₃ ⁻ , "	.002	.011	.054	.029	.016
Cl ⁻ , "	.000	.000	.000	.000	.000
F ⁻ , "	.000	.000	.000	.003	.001

** - T - Troposphere

S - Stratosphere

U - Uncertain or mixed

TABLE IV - FILTER DATA ON TAPE VL0013, CONCLUDED

Exposure Data

Filter no.	501-7	501-8
File, Flight	5,19	5,29
Route	THR-KHI	JFK-FRA
Date	9/11/77	9/15/77
Time, GMT	0032-0147	0143-0343
Latitude, deg	32-26N	43-53N
Longitude, deg	56-66E	70-45W
Altitude, km	9.9-10.1	9.7-10.1
Region **	T	U

Constituent Data

SO ₄ ²⁻ , $\mu\text{g}/\text{m}^3$	.006	.045
NO ₃ ⁻ , "	.021	.032
Cl ⁻ , "	.012	.000
F ⁻ , "	.003	.001

** - T - Troposphere
 S - Stratosphere
 U - Uncertain or mixed

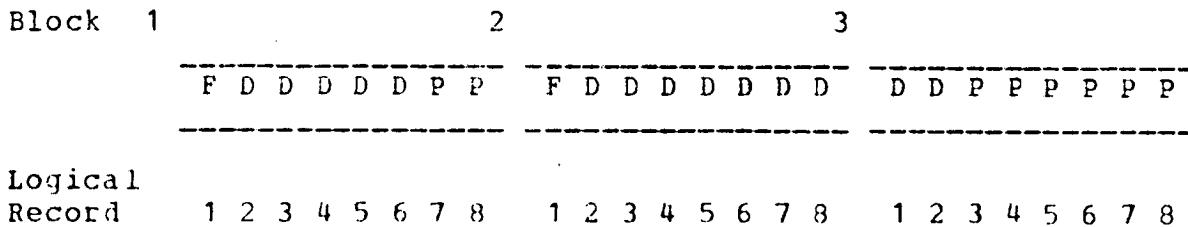
APPENDIX A - Specifications for GASP Archive Tapes (VLXXXX)

GENERAL

1. Tapes are written in EBCDIC format using nine track tapes.
2. Tape density is 800 BPI.
3. Physical records (blocks) are 4096 bytes.
4. The tapes are unlabeled, and contain one or more GASP data files. (On tapes < VL0009 these are followed by a tropopause pressure data file.)

GASP DATA FILE

1. Each GASP data file contains data from a single GASP aircraft. Within each file, data are grouped and identified by flights (takeoff to landing) in chronological order.
2. The GASP data for each flight begins with a logical FLHT record (flight identification data), which is followed by logical DATA records (one for each data recording made during the flight). Both FLHT and DATA records contain 512 bytes, hence there are 8 logical records per physical record (block).
3. An FLHT record will always be the first logical record in a block. However, every block need not begin with an FLHT record (i.e., if there are more than seven DATA records in a flight). If the FLHT record plus the available DATA records for a flight do not fill an integer number of blocks, the unused logical records in the final block are padded with zeros creating PADD records. The diagram below shows how several short flights would be blocked.



Block 4

5

6

Logical Record 1 2 3 4 5 6 7 8 1 2 3 4 5 6 7 8 1 2 3 4 5 6 7 8

where F is an FLHT record

D is a DATA record

P is a PADD record

4. The first four bytes in each logical record identify the record type as FLHT, DATA, or PADD. Detailed specification of the parameters and formats for FLHT and DATA records are given in Table A-I and A-II respectively.

- a) In each FLHT record, the number of DATA records to follow is given by NDATA (Bytes 78-81), and the number of blocks in the flight is given by NBLOCK (Bytes 82-84).
- b) For the last DATA record of each flight, LBFLG (Byte 5) = 'L'; for the last DATA record in each file, LBFLG = 'G' if the following file is a GASP data file, and LBFLG = 'T' if the following file is the tropopause pressure file; for all other DATA records, LBFLG = ' '.

Note: DATA records with LBFLG ≠ ' ' will be followed by PADD records if the physical record (block) is not complete.

Table A-I Format for FLHT Records

Bytes	Fortran Name	Fortran Format	Parameter Description, Units, and Comments
1-4	RECID	A4	RECID = 'FLHT'
5-10	TAPID	A6	Original GASP tape number, GPXXX
11-25	ACID	A15	Aircraft ID; Airline and tail number
26-28	APTLV	A3	Airport of departure (3 letter code)
29-34	DATLV	3I2	Date first DATA record this flight; Mo=29-30, Da=31-32, Yr=33-34
35-38	TIMLV	2A2	Time (GMT) first DATA record this flight; Hr=35-36, Min=37-38
39-43	LATLV	F5.2	Latitude (deg) of APTLV
44	LALVT	A1	Hemisphere of LATLV; 'N' or 'S'
45-50	LONLV	F6.2	Longitude (deg) of APTLV
51	LOLVT	A1	Hemisphere of LONLV; 'E' or 'W'
52-54	APTAR	A3	Airport of arrival (3 letter code)
55-60	DATAR	3I2	Date last DATA record this flight; Mo=55-56, Da=57-58, Yr=59-60
61-64	TIMAR	2A2	Time (GMT) last DATA record this flight; Hr=61-62, Min=63-64
65-69	LATAR	F5.2	Latitude (deg) of APTAR
70	LAART	A1	Hemisphere of LATAR, 'N' or 'S'
71-76	LONAR	F6.2	Longitude (deg) of APTAR
77	LOART	A1	Hemisphere of LONAR, 'E' or 'W'
78-81	NDATA	I4	Number of DATA records for this flight - see OVRFLO, byte 508
82-84	NBLOCK	I3	Total number of blocks for this flight - see OVRFLO, byte 508
85-87	O3ID	A3	Ozone instrument ID number*
88-90	COID	A3	Carbon monoxide instrument ID number*
91-93	PCSID	A3	Particle counter sensor ID number*
94-96	PCEID	A3	Particle counter electronics ID number*
97-99	H2OID	A3	Water vapor sensor ID number*
100-102	HYGID	A3	Hygrometer ID number*
103-105	CNID	A3	Condensation nuclei instrument ID number*
106-117		4A3	Spares

Table A-I Continued

Bytes	Fortran Name	Fortran Format	Parameter Description, Units, and Comments
118-122	D1	F5.3	Smallest particle radius (micrometers) for PC range 1
123-127	D2	F5.3	Smallest particle radius (micrometers) for PC range 2
128-132	D3	F5.3	Smallest particle radius (micrometers) for PC range 3
133-137	D4	F5.3	Smallest particle radius (micrometers) for PC range 4
138-142	D5	F5.3	Smallest particle radius (micrometers) for PC range 5
143	LIMCHK	A1	LIMCHK='T' if acceleration limit exceeded (NE>0) on any DATA record this flight; otherwise LIMCHK='F'
144	FILEX	A1	FILEX='T' if filter exposed this flight; otherwise FILEX='F'
145	FDATA	A1	FDATA='T' if filter data on tape; otherwise FDATA='F'
146-149	FPAKN	I4	Filter pack number
150-151	FILTN	I2	Filter number
152-161	FTYPE	A10	Filter type
162-167	FDATON	3I2	Filter exposure start date; Mo=162-163, Da=164-165, Yr=166-167
168-171	FTIMON	2A2	Filter exposure start time; (GMT); Hr=168-169, Min 170-171
172-176	FLATON	F5.2	Filter exposure start latitude (deg)
177	FLAONT	A1	Filter exposure start latitude tag; 'N' or 'S'
178-183	FLONON	F6.2	Filter exposure start longitude (deg)
184	FLOONT	A1	Filter exposure start longitude tag; 'E' or 'W'
185-190	FHTMON	F6.0	Filter exposure start altitude (meters)
191-196	FDATOF	3I2	Filter exposure stop date; Mo=191-192, Da=193-194, Yr=195-196
197-200	FTIMOF	2A2	Filter exposure stop time (GMT); Hr=197-198, Min=199-200
201-205	FLATOF	F5.2	Filter exposure stop latitude (deg)
206	FLAOF	A1	Filter exposure stop latitude tag; 'N' or 'S'
207-212	FLONOF	F6.2	Filter exposure stop longitude (deg)
213	FLOOF	A1	Filter exposure stop longitude tag; 'E' or 'W'
214-219	FHTMOF	F6.0	Filter exposure stop altitude (meters)

Table A-I Continued

Bytes	Fortran Name	Fortran Format	Parameter Description, Units, and Comments
220-229	FCOMP1	A10	Filter constituent 1 (name)
230-239	FCOMP2	A10	Filter constituent 2 "
240-249	FCOMP3	A10	Filter constituent 3 "
250-259	FCOMP4	A10	Filter constituent 4 "
260-269	FCOMP5	A10	Filter constituent 5 "
270-279	FDC1	F10.3	Data for constituent 1 (micrograms/m**3)
280-289	FDC2	F10.3	Data for constituent 2 (micrograms/m**3)
290-299	FDC3	F10.3	Data for constituent 3 (micrograms/m**3)
300-309	FDC4	F10.3	Data for constituent 4 (micrograms/m**3)
310-319	FDC5	F10.3	Data for constituent 5 (micrograms/m**3)
320	SBUEX	A1	SBUEX='T' if MODE=10 recording this flight; otherwise SBUEX='F'
321		A1	Spares**
322-324		I3	Spares**
325-332		4I2	Spares**
333-336		2A2	Spares**
337-341		F5.2	Spares**
342		A1	Spares**
343-348		F6.2	Spares**
349		A1	Spares**
350-355		F6.0	Spares**
356-361		3I2	Spares**
362-365		2A2	Spares**
366-370		F5.2	Spares**
371		A1	Spares**
372-377		F6.2	Spares**
378		A1	Spares**

Table A-I Completed

Bytes	Fortran Name	Fortran Format	Parameter Description, Units, and Comments
379-384		F6.0	Spares**
385-434		5A10	Spares**
435-444	FFLO	F10.1	Filter flow in ambient cubic meters**
445-484		4F10.1	Spares**
485-489	a	F5.3	O3 destruction constant (see eq. 1)
490-494	b	F5.3	O3 destruction constant (see eq. 1)
495-499	c	F5.1	O3 destruction constant (see eq. 1)
500-507	d	E8.2	O3 destruction constant (see eq. 1)
508	OVRFL0	I1	If OVRFL0>0, NDATA=NDATA+OVRFL0*7992, and NBLOCK=NBLOCK+OVRFL0*1000
509-512	SENS	F4.2	Carbon monoxide sensitivity correction factor

* If ID='M', no data for this instrument this flight

** Used on tapes VL0004, VL0005, and VL0006 for reporting data from "grab" sample bottle exposures - see TM X-73574, TM X-73608, and TM 73727

Table A-II Format for DATA Records

Bytes	Fortran Name	Fortran Format	Parameter Description, Units, and Comments
1-4	RECID	A4	RECID= 'DATA'
5	LBFLG	A1	LBFLG='L' if this is the last data record this flight; LBFLG='G' if this is the last GASP data record in the file and the following file is a GASP data file; LBFLG='T' if this is the last GASP data record in the file and the following file is a tropopause pressure file; otherwise LBFLG=' '
6-9	RECORD	I4	Record number on TAPID*
10	FRAME	I1	Frame number on TAPID*
11-12	MODE	I2	Program mode*: = 4 - normal recordings = 10 - continuous recordings
13	TYPE	A1	Record type*: = 'N' for normal recordings = 'L' for continuous limit recordings = 'C' for continuous recordings##
14	CYCLE	A1	Calibration cycle number, or CYCLE='D' for data; cal and data cycles alternate at 5 min intervals, unless MODE = 10 or TYPE = 'L'
15-20	DATE	3I2	Mo=15-16, Da=17-18, Yr=19-20
21-24	TIME	2A2	Time (GMT), Hr=21-22, Min=23-24
25-30	ALTFAV	F6.0	Pressure altitude (ft)
31-36	ALTMAV	F6.0	Pressure altitude (meters) - see ALTAG, byte 44
37-43	PAMB	F7.2	Ambient static pressure in hPa - calc from ALTFAV
44	ALTAG	A1	ALTAG='C', 'D', or 'G' indicates climb, descent, or ground If ALTAG='T', ALTMAV and TRPRHM are geopotential heights (m)
45-49	LAT	F5.2	Latitude (deg)
50	LATAG	A1	Latitude hemisphere, 'N' or 'S'
51-56	LONG	F6.2	Longitude (deg)
57	LONGTAG	A1	Longitude hemisphere, 'E' or 'W'

Table A-II Continued

Bytes	Fortran Name	Fortran Format	Parameter Description, Units, and Comments
58-62	XI	F5.2	Aircraft position in NMC grid coordinates
63-67	YJ	F5.2	Aircraft position in NMC grid coordinates
68-71	HEADG	F4.0	Aircraft heading (deg)
72	HEADGT	A1	Tag for HEADG**
73-76	TASK	F4.0	True airspeed (knots)
77-81	XMATAS	F5.3	Flight mach number
82	TATAG	A1	Tag for TASK and XMATAS**
83-86	WS	F4.0	Wind speed (knots)
87-90	WSM	F4.0	Wind speed (meters/sec)
91	WSTAG	A1	Tag for WS and WSM**
92-95	WDEG	F4.0	Wind direction (deg)
96	WDEGTG	A1	Tag for WDEG**
97-100	SAT	F4.0	Static (ambient) air temperature (deg C)
101	SATAG	A1	Tag for SAT**
102-229	ACC(I)	32F4.2	Vertical acceleration (G's); 32 values each record at 8/sec
230-233	ACCMAX	F4.2	Max of ACC(I)
234-237	ACCMIN	F4.2	Min of ACC(I)
238-239	NE	I2	Number of times ACC(I) > 1.2 or ACC(I) < 0.8
240	ACCTAG	A1	Tag for ACC(I), ACCMAX, ACCMIN, NE**
241-245	ZEN	F5.1	Solar elevation angle (deg); 0 deg = horizontal
246	SUNTAG	A1	SUNTAG='N' if sun below horizon**
247-252	O3	F6.0	Ozone data (ppbv)
253	O3TAG	A1	Tag for O3**
			If O3TAG='Z', O3 = instrument zero (ppbv) - see text
254-259	O3A	F6.0	Ozone ave (ppbv); for 128 sec preceding recording
260	O3ATAG	A1	Tag for O3A**
261-266	O3S	F6.0	Ozone std deviation (ppbv); for 128 sec preceding recording
267	O3STAG	A1	Tag for O3S**

Table A-II Continued

Bytes	Fortran Name	Fortran Format	Parameter Description, Units, and Comments
268-273	DFPTA	F6.1	Dew/frost point temperature (deg C)
274-279	WVMRA	F6.1	Water vapor mixing ratio (ppmw)
280	DFTAGA	A1	Tag for DFPTA and WVMRA; if DFPTA \geq SAT, DFTAGA='S'**
281-286	COAVG	F6.0	Carbon monoxide data (ppbv)
287	COTAGA	A1	Tag for COAVG** If COTAGA='Z', COAVG = instrument zero (mv) - see text If COTAGA='G', COAVG = instrument gain (mv) - see text
288-293	COA	F6.0	Carbon monoxide ave (ppbv); for 128 sec preceding recording
294	COATAG	A1	Tag for COA**
295-300	COSD	F6.0	Carbon monoxide std deviation (ppbv); for 128 sec preceding recording
301	COSTAG	A1	Tag for COSD**
302-311	PD1	1PE10.3	Particle density for particles $>$ D1 (particles/m**3)
312	PDTAG1	A1	Tag for PD1**
313-322	PD2	1PE10.3	Particle density for particles $>$ D2 (particles/m**3)
323	PDTAG2	A1	Tag for PD2**
324-333	PD3	1PE10.3	Particle density for particles $>$ D3 (particles/m**3)
334	PDTAG3	A1	Tag for PD3**
335-344	PD4	1PE10.3	Particle density for particles $>$ D4 (particles/m**3)
345	PDTAG4	A1	Tag for PD4**
346-355	PD5	1PE10.3	Particle density for particles $>$ D5 (particles/m**3)
356	PDTAG5	A1	Tag for PD5**
357-361	CLSEC	F5.0	Time in clouds (sec) during 255 sec preceding recording
362-365	CLAYR	F4.0	Number of cycles in and out of clouds (layers) during 255 sec preceding recording
366	CLTAG	A1	Tag for CLSEC and CLAYR; if CLSEC > 0, CLTAG='C'**
367-373	TRPRMB	F7.2	Tropopause pressure in hPa (mb); time and space interpolated from NMC data fields+

Table A-II Continued

Bytes	Fortran Name	Fortran Format	Parameter Description, Units, and Comments
374	TPTAG	A1	Tag for tropopause data+ If TPTAG=' ', TRPRMB from 12 hour interpolation If TPTAG='L', TRPRMB from 24 hour interpolation If TPTAG='E', TRPRMB from nearest NMC reporting period If TPTAG='T', TRPRMB from 1200 GMT reporting period # If TPTAG='M', data not available
375-381	DELP	F7.2	DELP = TRPRMB - PAMB, in hPa (mb) +
382-387	TRPRHM	F6.0	Tropopause height in meters+ If ALTAG≠'T', TRPRHM from TRPRMB assuming std. atm. If ALTAG='T', TRPRHM interpolated from NMC data fields
388-394	DELHGT	F7.0	DELHGT = ALTFAV*.3048 - TRPRHM, in meters, where TRPRHM from TRPRMB assuming std. atm.+
395	GMTTAG	A1	Tag for TIME** ++
396-401	CNC	F6.0	Condensation nuclei data; number/cc
402	CNTAG	A1	Tag for CNC**
403-408	AVA	F6.0	If CNTAG='Z', CNC = instrument zero (mv) - see text Condensation nuclei data; number/cc - average over 240 sec prior to recording - see text
409	AVATAG	A1	Tag for AVA**
410-415	ATKMAX	F6.0	Max condensation nuclei (number/cc) during 240 sec period for AVA - see text
416	AMXTAG	A1	Tag for ATKMAX**
417-422	ATKMIN	F6.0	Min condensation nuclei (number/cc) during 240 sec period for AVA - see text
423	AMNTAG	A1	Tag for ATKMIN**
424-428	RHOR	F5.3	Density ratio correction used in processing O3 and CO data - see text

Table A-II Completed

Bytes	Fortran Name	Fortran Format	Parameter Description, Units, and Comments
429-433	DENS	F5.3	Density ratio correction used in processing CN data - see text
434-440	033	F7.0	Inside (Cabin) ozone; ppbv
441	033TAG	A1	Tag for 033
442-446	CDENS	F5.3	Density ratio correction used in processing 033 data - see text
447-452	RPFLOM	F6.2	Conversion from particle counts to particle density
453-456	BLDGND	I4	15th stage bleed indicator--VL0010 only
457-460	BLDFLT	I4	15th stage bleed indicator--VL0010 only
461-512		52A1	Spares

- * Each recording period is 16 sec in duration with 4 frames/record; only 1 frame from each recording period is reported unless MODE = 10 or TYPE = 'L' or 'C'.
- ** If TAG='M', corresponding data field will be zero; the 'M' tag is used whenever data are not available, have been edited out, or an instrument is in a calibration cycle which is not used directly in the data processing.
- + Added beginning with VL0004 to provide time and space interpolated tropopause data
- ++ Added beginning with VL0006 to identify records for which GMT is not available
- # Added beginning with VL0007 to identify tropopause data obtained from 1200 GMT arrays when GASP GMT is not available
- ## Added beginning with VL0009 to identify continuous recordings with normal cal/data cycling - see CYCLE, byte 14.



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